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Development Document for Proposed Effluent Limitations Guidelines, New Source Performance Standards, and Pretreatment Standards for the Iron and Steel Manufacturing Point Source Category. Volume 5--Scale Removal Subcategory, Acid Pickling Subcategory

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This volume covers the subcategory of scale removing and acid pickling.

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and

PRETREATMENT STANDARDS

for the

IRON AND STEEL MANUFACTURING POINT SOURCE CATEGORY

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SCALE REMOVAL SUBCATEGORY

SECTION I

PREFACE

The USEPA is proposing effluent limitations guidelines and standards for the steel industry. The proposed regulation contains effluent limitations guidelines for best practicable control technology (BCT), and best available technology economically achievable (BAT) as well as pretreatment standards for new and existing sources (PSNS and PSES) and new source performance standards (NSPS) under Sections 301, 304, 306, 307 and 501 of the Clean Water Act.

This part of the Development Document highlights the Scale Removal Subcategory of the Iron and Steel Industry. Volume I of the Development Document discusses issues pertaining to the industry, while other volumes relate to the remaining subcategories of the industry.

SCALE REMOVAL SUBCATEGORY

SECTION II

CONCLUSIONS

This report highlights the technical aspects of EPA's study of the Scale Removal Subcategory of the Iron and Steel Manufacturing Category.

Based upon this current study and a review of previous studies, the Agency has reached the following conclusions:

1. The Agency is retaining the previous subdivision of the Scale Removal Subcategory into kolene and hydride scale removal operations. Studies were conducted to determine if any other factors warranted further subdivision of the subcategory. None were found to have a significant effect on subdivision.

2. The Agency is not proposing a limitation on cyanide for kolene operations, although the originally promulgated limitations contained such a limitation. The data gathered for this study do not indicate that this pollutant is present in the kolene wastewaters in high quantities. Also, the previously promulgated regulation contained a limitation for dissolved chromium. The Agency is now proposing a total chromium limitation in lieu of dissolved chromium since total chromium is on the toxic pollutant list.

3. EPA estimates that compliance with the proposed BPT and BAT limitations will result in significant removals of toxic and other pollutants. A summary of the removal occurring from compliance with those proposed limitations is shown below.

	Kolene Scale Removal Effluent Discharges (Tons/Year)		
	Raw Waste	Proposed BPT	Proposed BAT
Flow (MGD)	1.24	1.24	0.79
TSS	1544.43	32.18	12.34
Toxic Metals	584.70	2.57	0.57
Toxic Organics	0.039	0.039	0.025
Other Pollutants	514.8	0.064	0.041

	Hydride Scale Removal Effluent Discharges (Tons/Year) Raw Waste	 Proposed BPT	 Proposed BAT
Flow (MGD)	1.44	1.44	0.12
TSS	810.36	40.52	2.02
Toxic Metals	21.02	5.16	0.14
Toxic Organics	1.62	0.41	0.034
Other Pollutants	64.83	1.62	0.027

4. Based upon facilities in place as of January 1, 1978 the Agency estimates the following costs to the industry will result from compliance with the proposed BPT and BAT limitations.

Kolene Scale Removal

	Costs (Millions of July 1, 1978 Dollars)			
	Investment Costs			Annual
	Total	In-place	Required	Costs
BPT	6.59	3.18	3.41	1.58
BAT	2.66	0.14	2.52	0.48
TOTAL	9.25	3.32	5.93	2.06

Hydride Scale Removal

	Costs (Millions of July 1, 1978 Dollars)			
	Investment Costs			Annual
	Total	In-place	Required	Costs
BPT	0.89	0.63	0.26	0.32
BAT	0.56	0.00	0.56	0.10
TOTAL	1.45	0.63	0.82	0.42

5. The Agency evaluated the "cost-reasonableness" of controlling the conventional pollutants based upon BCT alternative treatment systems. The control costs, for kolene operations, are greater than the costs experienced by publicly owned treatment works (POTWs). Therefore, the proposed BCT limitations for those operations are identical to the proposed BPT limitations for conventional pollutants. The control costs, for hydride operations, are less than the costs experienced by publicly owned treatment works (POTWs). Therefore, The Agency is proposing BCT limitations based upon the BCT model treatment system.

6. The proposed NSPS and the NSPS model treatment system are similar to the proposed BAT limitations and the BAT model treatment system, respectively. However, the discharge flow rates for the NSPS system are less than the BAT system and the NSPS is based on that lower flow rates.

7. EPA is proposing pretreatment standards for new and existing sources (PSNS and PSES) discharging wastewaters to POTWs. These standards limit the amount of toxic pollutants which can be discharged to POTWs. The standards are intended to minimize the impact from pollutants which could interfere with, pass through, or are otherwise incompatible with POTW operations. PSNS standards and technologies are the same as the standards and technologies for NSPS. PSES technologies are the same as NSPS technologies, but the flow is retained at the BAT level of treatment. Conventional pollutants are not included in pretreatment standards.

8. Three Phase II remand issues which had a direct bearing on the scale removal subcategory are addressed in detail in this report. A summary of these issues is presented below.

   a. The remand required examination of the degree of water consumption that would result from the installation of the proposed treatment systems. Since the alternative treatment systems considered for scale removal operations do not employ recycle or cooling systems no impact is expected on water consumption as a result of the applicaton of the proposed effluent limitations.

   b. The Agency evaluated the adequacy of previous cost estimates with regard to site-specific factors. An analysis was made comparing cost estimates based upon model plant considerations to actual cost data provided for scale removal operations. However, since wastewaters for all mills for which data were provided are treated in large central treatment systems, the Agency found it impossible to segregate those costs and therefore could not directly compare those costs on a subcategory basis. Nevertheless, the adequacy of the cost model to account for site-specific factors has been verified and is presented in Volume I. The comparison is made on a central treatment basis.

   c. Neither relaxed effluent limitations nor retrofit cost allowances are necessary for older scale removal operations. Analysis indicates that the age of a scale removal operation has no significant effect upon the ease or cost of retrofitting pollution control equipment.

9. Although a significant number of toxic pollutants were found to be present in the raw wastewater from scale removal operations, the Agency believes it is not necessary to establish limitations for each toxic pollutant. Adequate control of those toxic pollutants not specifically limited is attained by controlling the pollutants for which limitations are proposed. By limiting the discharge of these pollutants, effective control is provided for all toxic pollutants identified in raw wastewaters.

10. The Agency is proposing NSPS and PSNS based upon model effluent flows of 200 gal/ton and 50 gal/ton for kolene and hydride operations, respectively, and is considering promulgating the

BAT, BCT, and PSES limitations and standards based on those same flows as opposed to those contained herein (320 gal/ton and 100 gal/ton for kolene and hydride operations, respectively). The Agency is soliciting comments on whether model flows of 200 gal/ton and 50 gal/ton are appropriate for kolene and hydride operations, respectively, at the BAT, BCT and PSES levels.

11. Table II-1 presents the treatment model flow and effluent quality data used to develop the proposed BPT effluent limitations for the scale removal subcategory, and Table II-2 presents these proposed limitations. Table II-3 presents the treatment model flow and effluent quality data used to develop the proposed BAT and BCT effluent limitations and the proposed NSPS, PSES, and PSNS for the scale removal subcategory; Table II-4 presents these proposed limitations and standards.

TABLE II-1

BPT TREATMENT MODEL FLOW AND EFFLUENT QUALITY SCALE REMOVAL SUBCATEGORY

KOLENE

Pollutant	Monthly Average Concentration (mg/1)(1)
Flow, gal/ton	500
TSS	25
Chromium, hexavalent	0.05
Iron, dissolved	1.0
pH, Units	6.0 to 9.0
119 Chromium	0.5

HYDRIDE

Pollutant	Monthly Average Concentration (mg/1)(1)
Flow, gal/ton	1200
TSS	25
Chromium, hexavalent	0.05
Iron, dissolved	1.0
pH, Units	6.0 to 9.0
119 Chromium	0.5
121 Cyanide	0.25

---

(1) Daily maximum concentrations are three times the monthly average concentrations presented above.

TABLE II-2

BPT PROPOSED EFFLUENT LIMITATIONS SCALE REMOVAL SUBCATEGORY

KOLENE

Pollutant	Effluent Limitations (kg/kkg of Product)(1)
TSS	0.0521
Chromium, hexavalent	0.00010
Iron, dissolved	0.0021
pH, Units	6.0 to 9.0
119 Chromium	0.0010

HYDRIDE

Pollutant	Effluent Limitations (kg/kkg of Product)(1)
TSS	0.125
Chromium, hexavalent	0.00030
Iron, dissolved	0.0050
pH, Units	6.0 to 9.0
119 Chromium	0.0025
121 Cyanide	0.0013

---

(1) Daily maximum effluent limitations are three times the monthly average effluent limitations presented above.

TABLE II-3

TREATMENT MODEL FLOWS AND EFFLUENT QUALITY SCALE REMOVAL SUBCATEGORY

KOLENE

	Pollutant	Monthly Average Concentration (mg/1)(1)				
		BAT	BCT	NSPS	PSES	PSNS
	Flow, gal/ton	320	500	200	320	200
	TSS	-	25	15	-	-
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
119	Chromium	0.10	-	0.10	0.10	0.10

HYDRIDE

	Pollutant	Monthly Average Concentration (mg/1)(1)				
		BAT	BCT	NSPS	PSES	PSNS
	Flow, gal/ton	100	100	50	100	50
	TSS	-	15	15	-	-
	pH, Units	-		6.0 to 9.0	-	-
119	Chromium	0.10	-	0.10	0.10	0.10
121	Cyanide	0.25	-	0.25	0.25	0.25
122	Lead	0.10	-	0.10	0.10	0.10

---

(1) Daily maximum concentrations are the above monthly average concentrations multiplied by the following factors:

	Pollutant	Factor
	TSS (all except Kolene BCT)	2.67
	TSS (Kolene BCT)	3
119	Chromium	3
121	Cyanide	3
122	Lead	3

TABLE II-4

PROPOSED EFFLUENT LIMITATIONS AND STANDARDS
SCALE REMOVAL SUBCATEGORY

KOLENE

	Pollutant	Effluent Limitations (kg/kkg of Product)(1)				
		BAT	BCT	NSPS	PSES	PSNS
	TSS	-	5210	1300	-	-
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
119	Chromium	13	-	8.4	13	8.4

HYDRIDE

	Pollutant	Effluent Limitations (kg/kkg of Product)(1)				
		BAT	BCT	NSPS	PSES	PSNS
	TSS	-	620	310	-	-
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
119	Chromium	4.2	-	2.1	4.2	2.1
121	Cyanide	10	-	5.2	10	5.2
122	Lead	4.2	-	2.1	4.2	2.1

---

(1) The proposed limitations and standards have been multiplied by 10^5 to obtain the values presented in this table.

Daily maximum effluent limitations and standards are the above monthly average limitations and standards multiplied by the following factors:

	Pollutant	Factor
	TSS (all except Kolene BCT)	2.67
	TSS (Kolene BCT)	3
119	Chromium	3
121	Cyanide	3
122	Lead	3

SCALE REMOVAL SUBCATEGORY

SECTION III

INTRODUCTION

General Discussion

Scale removal is the operation in which specialty steel products are processed in molten salt solutions for surface cleaning. Two types of solutions are used in the scale removal process - kolene and hydride. As a result of the different characteristics of these solutions, the Agency is proposing separate limitations for each process.

Pollutants are generated by two sources in the scale removal process; the bath containing the kolene or hydride solution and the rinse or quench steps following the scale removal bath. Both sources contain the same pollutants but at different levels. Since spent descaling solutions from most plants are hauled off-site for disposal the proposed limitations are based primarily upon flow and effluent quality data for the rinse or quench steps. The bath contains a small volume of solution which is used for a long period of time before being discarded. This small volume could be gradually bled into a treatment system, and no extra allowances for this procedure would be needed. However, this practice is not recommended.

As with many other steel finishing operations, there are two modes of scale removal operations - batch and continuous. These are detailed in Figures III-1 and III-2. The pickling step shown after the scale removal step depicts the typical processing train in a specialty steel scale removal/pickling line. However, the proposed limitations and standards developed and proposed herein apply only to the scale removal portion. The pickling operation is addressed in a separate subcategory.

Development of Regulations

The regulation governing the scale removal process was previously promulgated on March 29, 1976, and contained limitations for a number of pollutants (see Section VI). For this study, the Agency conducted additional sampling and gathered detailed information from the steel industry to provide an expanded data base. On the basis of these new data, the Agency concluded that revisions of the March 29, 1976 BPT limitations is appropriate.

Responses to the basic data collection portfolios (DCPs) sent to approximately 85% of the active scale removal operations in the country are the primary source of new data. DCPs requested information on process and discharge flow rates, installed treatment systems, mill capacities and modes of operation. Information for twenty-four kolene operations and eight hydride operations was provided in the responses to the DCPs. The data supplied for these mills have been tabulated and summarized in Tables III-1 through III-3.

After the DCP responses were reviewed, the Agency sent detailed DCPs (D-DCPs) to selected mills to gather information on long term effluent quality, cost information for the installed treatment systems, and on the scale removal operation. The Agency solicited information for seven scale removal mills through D-DCPs. The responses to questionnaires were useful in providing data needed to verify cost estimates, to consider retrofit costs, and in providing additional effluent data.

The March 29, 1976 regulation was primarily based upon data obtained through field sampling at four scale removal operations. During this study, the Agency conducted sampling at six additional lines to increase the data base for the previously limited pollutants and to monitor for the presence of toxic pollutants. A complete list of all scale removal operations sampled for this study and a basic description of each is provided in Table III-4. As shown, the Agency resampled two mills. Data collected at each sampling visit are presented in this report; however, only the data gathered at the later visit have been used and for developing limitations. The updated data base for this subcategory is shown in Tables III-5 and III-6.

Description of Scale Removal Operations

A. Kolene Descaling

The kolene process employs highly oxidizing salt baths maintained at temperatures of 700-900°F. These salts react far more aggressively with scale than with the base metal and, therefore, result in a smoother surface than is obtainable with acid pickling.

The usual kolene process is carried out in the following manner. The steel product, after annealing, is placed in the kolene bath. When the product has soaked a sufficient time for necessary chemical and thermal action it is quenched in a "cold" water tank. The combination of the chemical action and the sudden thermal shock and steam formation causes the scale on the surface to crack so that subsequent pickling operations can be more effective. Another important function of the quenching operation is to cool the product. Without adequate cooling, the immersion of the product into an aggressive acid solution such as nitric and nitric/hydrofloric will cause overheating of the acid bath and an undesirable attack on the base alloys.

Kolene baths in the alloy and stainless steel industry are not separate processes but are operated as an integral part of the pickling process. More detail on the kolene operation is shown in Figures III-1 and III-2.

B. Hydride Descaling

Sodium hydride descaling depends upon the strong reducing properties of sodium hydride carried at 1.5 to 2 percent by weight in a fused caustic soda bath at 700°F. Most scale forming oxides are reduced to the base metal, and oxides of metals that form acid radicals are partly reduced. The hydride is formed in place by the reaction of hydrogen and sodium in open bottom chambers partially immersed in the bath. Most commercial operations use ammonia as a source of hydrogen. Hydride operations, like kolene operations, are operated as an integral part of the pickling process. More detail on the hydride operation is illustrated in Figures III-1 and III-2.

TABLE III-1

GENERAL DATA SUMMARY
KOLENE - BATCH TYPE

Plant Code	Type of Product	Plant Age	Capacity(TPD)	Applied Flow (GPT)	Discharge Flow (GPT)	Control and Treatment Technologies(2)	Treatment Plant Age	Discharge To POTW
020B-01	Sheet, Plate	1947	99	UNK	91	CR,NL,FLP,VF,CL,CNT	1974	No
060I	Rod, Wire	1970(1)	190	380	380	CR,NC,NA,CNT(12)	1972	No
088A-01	Tube	1962	69	1774	1774	CR,E,NL,FLP,CL,T,VF,SS, CNT(10)	1969	No
088A-02	Tube	1946	36	1553	1553	CR,E,NL,FLP,CL,T,VF,SS, CNT(4)	1969	No
176-04	Rod, Wire	1968	203	[461]	[461]	CNT(17),CL,PSP,NA,CO,CLA, EB,FLP,NC,NW,CL,SL,SSP, T,SS,CY	1965	No
248D	Pipe, Tube	UNK	1	1026	1026	CNT(1),NA,T	1975	No
256L	Sheet	1962	*	*	*	CNT(50),VF,FLP,CR,NL,NC,PSP, SSP	1977	No
424	Plate	1960	NA	[494]	[494]	VF,CR,FLP,NL,NW,NA,CL,SL,T	1960	No
430C	Sheet, Plate	1962	54	1467	1467	RET(100)		
440A	Bar, Rod	1958	63	[342]	[342]	NW,SL	UNK	Yes
776G	Bar, Rod, Wire	1960	5	1283	1283	CNT(55),FLP,NC,FD	1976	No
776H	Sheet	1960	13	391	391	CNT(67),NW,CL,T	NA	No
856E	Sheet,Plate	1956	78	1846	1846	Not Available	NA	No

---

(1) Mill converted from a hydride operation to a kolene operation. Line initially installed in 1946.
(2) For definition of codes refer to Table VII-1.

[] Brackets represent flow data gathered on the sampling visit for this mill.
*: Confidential data.
TPD: Tons/Day
GPT: Gal/Ton

TABLE III-2

GENERAL DATA SUMMARY
KOLENE - CONTINUOUS TYPE

Plant Code	Type of Product	Plant Age	Capacity(TPD)	Applied Flow (GPT)	Discharge Flow (GPT)	Control and Treatment Technologies(1)	Treatment Plant Age	Discharge To POTW
020B-02	Sheet	1957	210	UNK	UNK	CR,NL,FLP,VF,CL,CNT(4.6)	1974	No
060D	Strip	1961	300	UNK	UNK	VF,FLP,NL,CL,CR	1961	No
248B-02	Sheet	1975	NA	UNK	UNK	SCR,NL,FLP,CL,T,FP,CNT(18)	1978	No
2560	Strip	1972	*	*	*	VF,FLP,CL,NL,CNT(1)	1978	No
284A	Strip	1957	138	104	104	CNT(6),CR,NL,FLP,CL,CY	1971	No
432L	Strip	1959	34	UNK	UNK	None	UNK	UNK
528-02	Sheet	1955	153	235	235	CNT,SS,NL	UNK	Yes
528-03	Sheet	1956	54	667	667	CNT,SS,NL	UNK	Yes
528-04	Sheet	1956	90	400	400	CNT,SS,NL	UNK	Yes
528-05	Sheet	1975	210	617	617	CNT,SS,NL	UNK	Yes
684D	Strip	UNK	69	[167]	[167]	Not Available	UNK	NA

---

(1) For definition of codes refer to Table VII-1.

[] Brackets represent flow data gathered on the sampling visit for this mill.
*: Confidential data.
TPD: Tons/Day
GPT: Gal/Day

TABLE III-3

GENERAL DATA SUMMARY
HYDRIDE
BATCH AND CONTINUOUS OPERATIONS

Plant Code	Type of Product	Plant Age	Capacity(TPD)	Applied Flow (GPT)	Discharge Flow (GPT)	Control and Treatment Technologies (1)	Treatment Plant Age	Discharge To POTW
176-01	Bar, Rod, Wire	1941	173	[611]	[611]	CNT(17),CR,PSP,NA,CO,CLA,EB, FLP,NC,NW,CL,SL,SSP,T,SS, CY	1965	No
176-02	Rod, Wire	1950	262	330	330	CNT(9),CR,PSP,NA,CO,CLA,EB, FLP,NC,NW,CL,SL,SSP,T,SS, CY	1965	No
176-03*	Strip	1963	20	1818	1818	CNT(4),CR,PSP,NA,CO,CLA,EB, FLP,NC,NW,CL,SL,SSP,T,SS, CY	1965	No
284B-01	Sheet	1950	NA	UNK	UNK	CNT(18),SCR,NL,FLP,CL,T,FP	1978	No
256K	Wire	1956	165	87	87	CNT(1),FLP,NL,CL	1971	No
256N	Bar, Billet	1955	27	[1.8]	[1.8]	CLA,NA,SL,CNT(66)	1973	Yes
684P	Wire	1945	17	102	33	Not Available	NA	No
684V	Sheet, Plate	UNK	UNK	UNK	UNK	Not Available	NA	NA

---

(1) For definition of codes refer to Table VII-1.

*: Continuous Mill.
[] Brackets represent flow data gathered on the sampling visit for this mill.
TPD: Tons/Day
GPT: Gal/Ton

TABLE III-4

SUMMARY OF THE MILLS SAMPLED DURING THIS STUDY SCALE REMOVAL SUBCATEGORY

Plant Code	Reference No.	Type of Operation	Product Processed	Mill Age
C	424-01	Kolene - Batch	Plate	1960
L	440A-01	Kolene - Batch	Bar, Rod	1958
Q	684D	Kolene - Continuous	Strip	Unk
L	440A	Hydride - Batch	Unk	Unk
131	424-01	Kolene - Batch	Plate	1960
132	176-04	Kolene - Batch	Rod, Wire	1968
138	440A-01	Kolene - Batch	Bar, Rod	1958
137	432K	Kolene - Continuous	Sheet	1958
132	176-01	Hydride - Batch	Bar, Rod, Wire	1941
139	256N-01	Hydride - Batch	Bar, Billet	1955

TABLE III-5

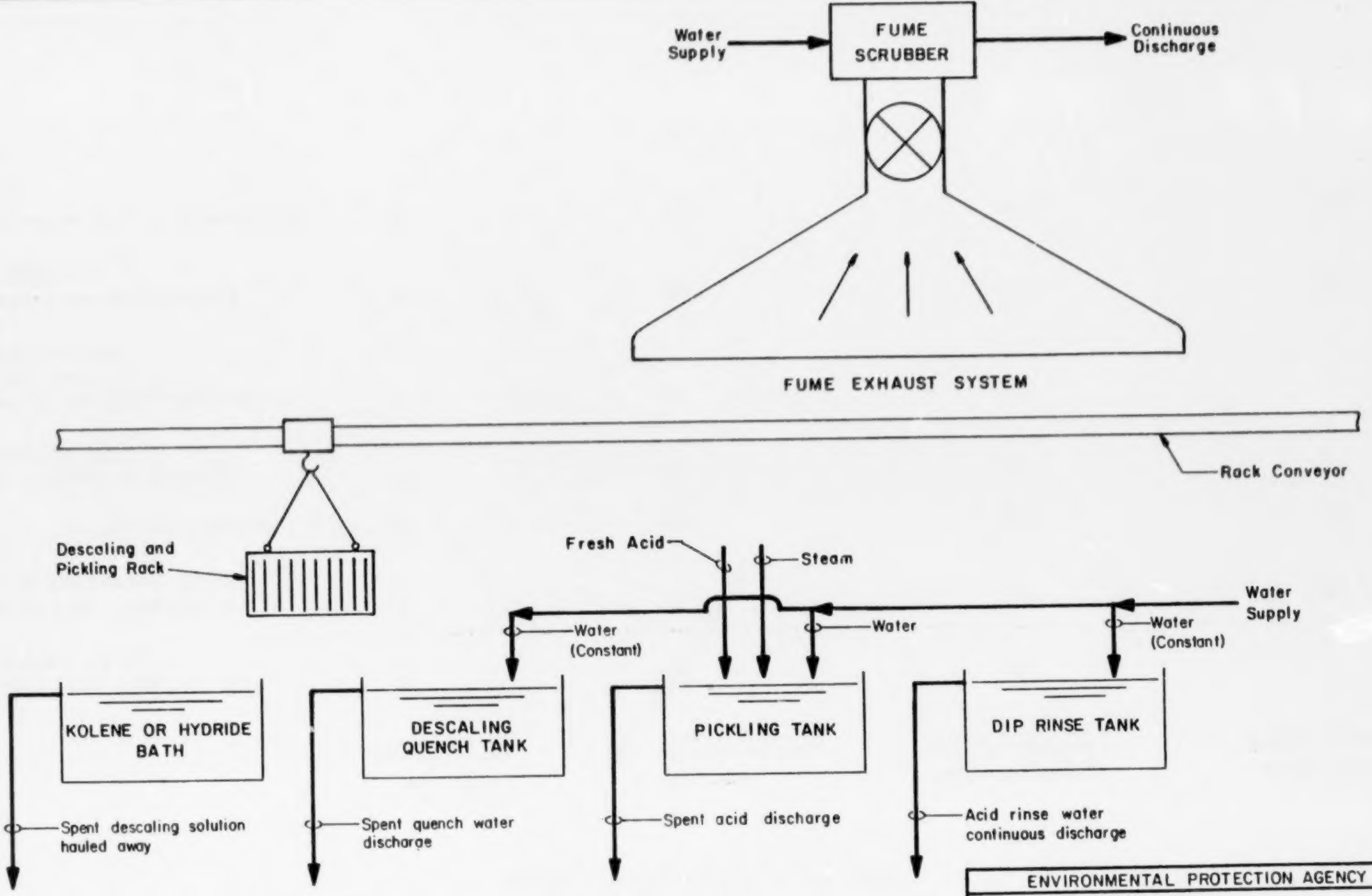
KOLENE SCALE REMOVAL DATA BASE
BATCH AND CONTINUOUS OPERATIONS

	No. of Operations	% of Total No. of Operations	Daily Capacity of Operations	% of Total Daily Capacity
Operations Sampled for Original Study	3	11	132	5
Operations Sampled for Toxic Pollutant Study	5 incl. 3 above	18 incl. 11 above	515 incl. 132 above	21 incl. 5 above
Total Operations Sampled	5	18	515	21
Operations to Receive Detailed DCP	6	21	571	23
Operations Sampled and/or Solicited via Detailed DCP	11	39	1086	45
Operations Responding to DCP's	24	86	2069	85
Estimated No. of Operations	28	100	2434	100

TABLE III-6

HYDRIDE SCALE REMOVAL DATA BASE
BATCH AND CONTINUOUS OPERATIONS

	No. of Operations	% of Total No. of Operations	Daily Capacity of Operations	% of Total Daily Capacity
Operations Sampled for Original Study	1	11	21	3
Operations Sampled for Toxic Pollutant Study	2	22	200	26
Total Operations Sampled	3	33	221	28
Operations to Receive Detailed DCP	1	11	27	3
Operations Sampled and/or Solicited via Detailed DCP	4	44	248	32
Operations Responding to DCP's	8	89	664	85
Estimated No. of Operations	9	100	781	100

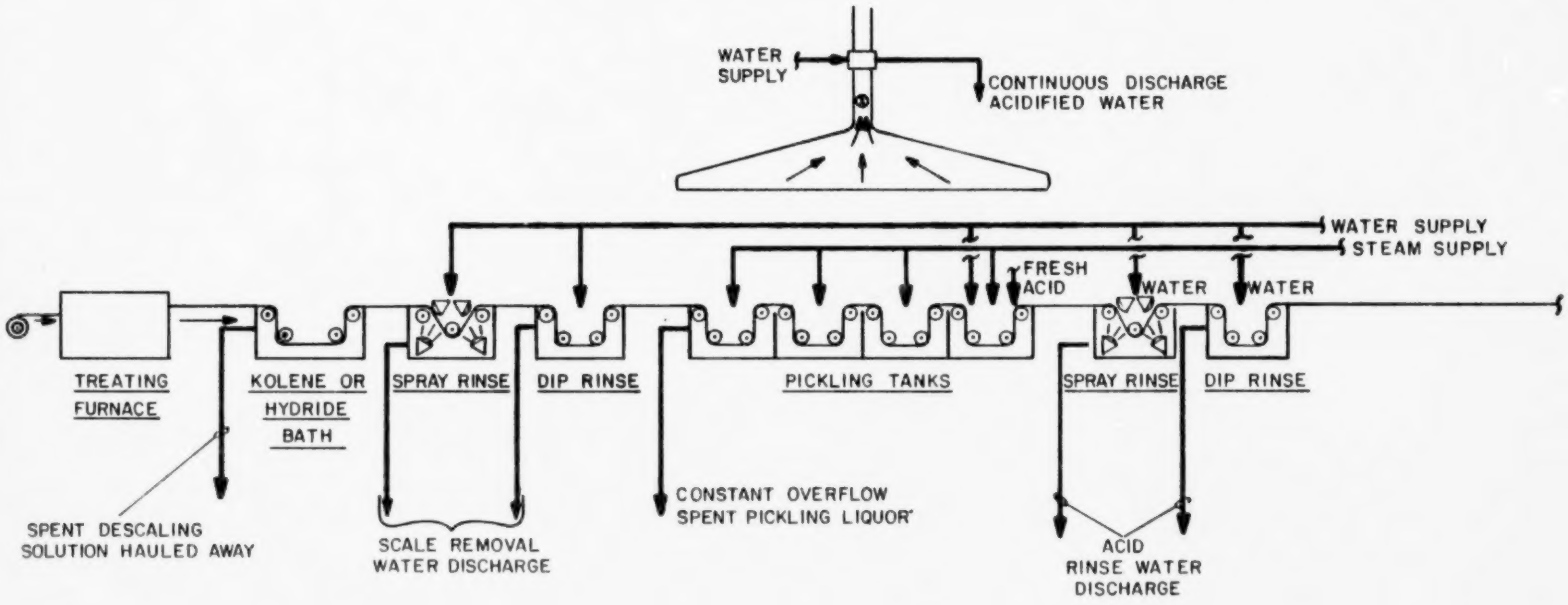


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SCALE REMOVAL
KOLENE AND HYDRIDE
BATCH TYPE OPERATION

Dwn. 3/2/79

FIGURE III-1


WATER SUPPLY
CONTINUOUS DISCHARGE ACIDIFIED WATER
WATER SUPPLY
STEAM SUPPLY
FRESH ACID
WATER
WATER
TREATING FURNACE
KOLENE OR HYDRIDE BATH
SPRAY RINSE
DIP RINSE
PICKLING TANKS
SPRAY RINSE
DIP RINSE
SPENT DESCALING SOLUTION HAULED AWAY
SCALE REMOVAL WATER DISCHARGE
CONSTANT OVERFLOW SPENT PICKLING LIQUOR
ACID RINSE WATER DISCHARGE

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SCALE REMOVAL
KOLENE AND HYDRIDE
CONTINUOUS TYPE OPERATION

Dwn. 3/2/79

FIGURE III-2

SCALE REMOVAL SUBCATEGORY

SECTION IV

SUBCATEGORIZATION

Introduction

As the two types of scale removal operations are significantly different, a subdivision of the scale removal subcategory into two subdivisions is appropriate. Different flow rates and wastewater characteristics were noted for each of the two operations.

The Agency examined other factors but none indicated that further subdivision was appropriate. Mill age and size were analyzed to determine if these had an effect on wastewater quality or quantity, but no significant impacts were found. In addition, the Agency considered whether factors including product type and raw materials had a significant effect but found that further subdivision of the scale removal subcategory on those bases was not appropriate. Each of these factors is discussed in greater detail below.

Factors Considered in Subdivision

Manufacturing Process and Equipment

The analysis completed for this study shows that there are significant differences in kolene and hydride scale removal operations. Effluent flow rates, wastewater characteristics and other factors resulting from the process make subdivision of this subcategory on the basis of the type of descaling operation appropriate.

Final Product

The products that are processed in either hydride or kolene baths include sheet, strip, rod, wire, tubes and bars. However, final products do not affect any element to a significant degree and thus do not affect subdivision. This finding has also been made for other steel finishing subcategories.

As shown in Table III-4, numerous products are descaled by operations sampled for this study. No significant variations were found in wastewater quality that could be attributed to the product. Also, similar effluent quality can be attained regardless of the product descaled. It was also found that applied and discharge flow rates are not significantly affected by the type of product processed. Flow rates used to develop the proposed limitations can be achieved for operations processing all product types studied.

Based upon the above, further subdivision based upon product type is not appropriate for scale removal operations.

Raw Materials

Only specialty steels are processed in kolene and hydride baths, and while the elements of the specialty steel (i.e., percentage of Cr or Ni) may vary, the Agency did not find any significant difference in flow or wastewater characteristics resulting from the processing of the various types of specialty steel. Kolene descaling is better suited for certain types of steels (i.e.,chromium-nickel, high temperature and nickel product grades) and hydride descaling for other types such as tool steel and chromium stainless and alloy grades, but these differences are accounted for under the subdivision into kolene and hydride operations.

Wastewater Characteristics

Wastewater characteristics and flow rates vary significantly between the two descaling processes, which make the subdivision into kolene and hydride descaling appropriate. In addition to different flow rates, different pollutants are found in the raw wastewaters of the two processes. Based on these differences, the Agency developed different alternative treatment systems. The rationale for developing the alternative treatment systems is explained in Sections VII-XIII.

Wastewater Treatability

Different treatment configurations are required for kolene and hydride operations. For example, hydride operations discharge quantities of cyanide that must be treated while the wastewater from kolene operations do not contain significant amounts of cyanide. Likewise, kolene operations discharge large amounts of hexavalent chromium while this pollutant is not normally found at significant levels in wastewater from hydride operations.

Within each operation, however, no significant differences in wastewater treatability was found. Pollutants in the wastewater from the various kolene operations can be reduced to acceptable levels if adequate treatment is installed. Wastewaters from batch and continuous operations contain similar levels of pollutants. The same type of treatment is equally effective for either type. These same relationships hold true for hydride operations.

For these reasons, the Agency believes that subdivision by the type of scale removal bath is sufficient to cover the variations in wastewater treatability.

Size and Age

The Agency considered the impact of size and age on the subdivision of scale removal operations. Various relationships were analyzed dealing with possible correlations between the effect of age and size on wastewater generation, the ability to install treatment, and the ability to achieve the desired flow rates and proposed effluent limitations. However, the analysis did not show any significant relationships which might affect subdivision. Hence, the proposed limitations and standards apply to lines of all sizes and ages.

Size was considered a possible factor for subdivision but from the analysis of the compiled data, size does not justify further subdivision. Scale removal operations vary greatly in physical size, layout and product size. However, these considerations revealed no relationships to process water usage, discharge rates, effluent quality or any other pertinent factor. Figures IV-1 and IV-2 are plots which analyze the possible relationship between discharge flow and size. On the plots, flow rates used to develop the proposed limitations are shown to determine if line size is a determining factor in achieving the proposed limitations. As can be seen in these plots, the respective flows can be achieved at lines of any size. In addition, size does not affect wastewater characteristics. Since all lines are operated in a similar manner, the wastewater characteristics remain relatively constant regardless of size. The sampling data do not show any differences in wastewater characteristics between lines of different size.

It was also found that the size of the line does not affect the ability to install adequate treatment systems. Large and small lines have treatment systems that are approximately the same age and which have similar treatment components. Also, the cost data developed for this study show treatment can be installed for approximately the same cost on a $/ton basis.

The relationship between flow and age was analyzed in the same way as the flow and size relationship. The plots of flow versus age for the kolene and hydride operations are shown in Figures IV-3 and IV-4. No relationships between flow and age are evident. Therefore, the Agency believes that age has no significant impact on discharge flow.

Another element analyzed is the effect of age on the ability, ease and cost of installing or retrofitting pollution control equipment. Table IV-1 lists those companies that have retrofitted pollution control equipment at older lines. The numerous examples effectively illustrate the ability to retrofit treatment systems to older lines.

The ease and cost of retrofitting pollution controls was evaluated from the responses to the D-DCPs. Cost data were provided for three older lines that retrofitted pollution control equipment. No retrofit costs were reported for two lines and a nine percent retrofit cost was reported for the third. However, the detailed information to account for this additional cost which was requested by the Agency was not provided. As a result, the Agency was not able to assess the significance of this retrofit cost, or whether it is, in fact, wholly attributable to retrofitting pollution control equipment. Inasmuch as the other two facilities reported no retrofit costs, the nine percent cost reported for the third facility appears to be unique. However, the Agency does not believe this nine percent retrofit cost is substantial. Hence, the Agency has not further subdivided the scale removal subcategory on the basis of costs for retrofitting pollution control equipment of other mills. It should be noted that scale removal wastewaters are generally combined with other process wastewaters and treated in a control treatment plant.

The Agency also analyzed the sampling data collected during this study to determine if age has a significant effect on wastewater characteristics or effluent quality. The dates of construction of the lines sampled varied from 1941 to 1968. No significant differences were noted between the effluent quality attained at the older lines versus the newer lines. Acceptable levels of pollutants were being achieved at lines of all ages where adequate treatment was installed.

Age and size do not affect the ability to achieve the model flow rates and effluent quality, or to install the appropriate pollution control technologies. Thus, the Agency concludes that subcategorization based upon these factors is not appropriate.

Geographic Location

Examination of raw waste characteristics, process water application rates, discharge rates, effluent quality and other pertinent factors related to the discharge reveals no general relationship or pattern to plant location. Scale removal lines are located in only five states, with about 77% located in Pennsylvania and Ohio.

A few lines are located in what could be considered "semi-arid" or "arid" regions. For this reason, the consumptive use of water was considered. However, because the model treatment systems do not employ recycle or cooling systems consumption of water due to wastewater treatment is negligible.

Process Water Usage

Water is used in scale removal operations to rinse and cool the products, following immersion in the kolene or hydride bath. Because of process requirements and the nature of wastewaters discharged from the scale removal lines, no recycle systems are installed at any of the lines surveyed. All process waters are used on a once-through basis. As a result, the water application and discharge flow rates are the same.

The observed and reported flow rates from scale removal operations are highly variable. The Agency, however, believes that this variability results from excessive use of water. The Agency further believes that the differences can be minimized through careful control of water usage. Water should be applied only during the period that product is being rinsed and cooled; and the application rate should be controlled to meet strict operational (rinsing and cooling) requirements. Under these conditions, the Agency believes that the discharge flow rates from scale removal operations will be similar. As a result, the Agency concludes that further subdivison on the basis of process water usage is not warranted.

TABLE IV-1

EXAMPLES OF SCALE REMOVAL OPERATIONS THAT HAVE RETROFITTED TREATMENT

	Plant Code	Plant Age	Treatment Plant Age
Kolene			
	60I	1970	1972
	88A	1962	1969
	256L	1962	1977
	776G	1960	1976
	20B	1957	1974
	248B	1975	1978
	2560	1972	1978
	248A	1957	1971
Hydride			
	176	1941	1965
	248B	1950	1978
	256K	1956	1971
	256N	1955	1973

FIGURE IV-1
SCALE REMOVAL SUBCATEGORY
KOLENE

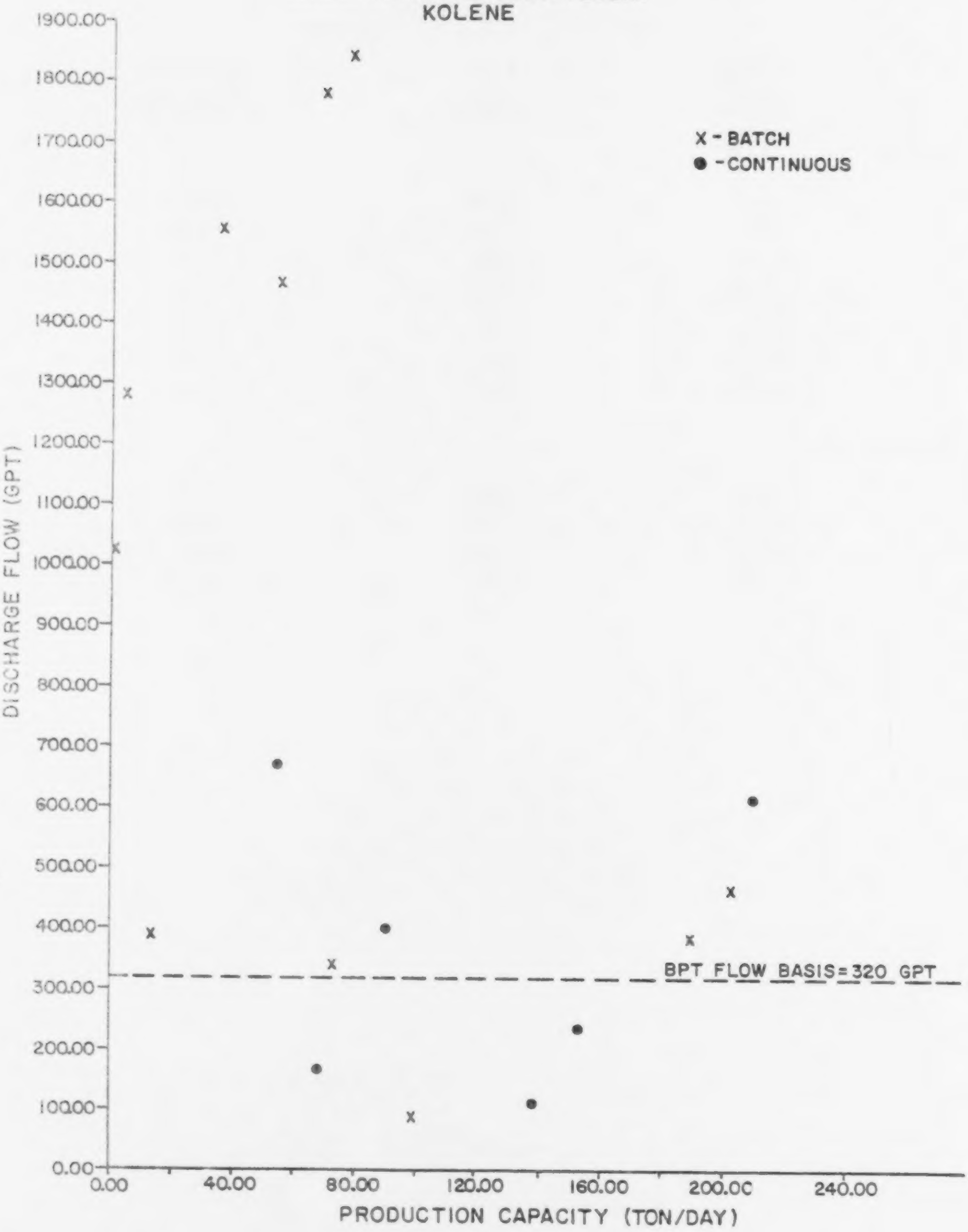


FIGURE IV - 2
SCALE REMOVAL SUBCATEGORY
HYDRIDE

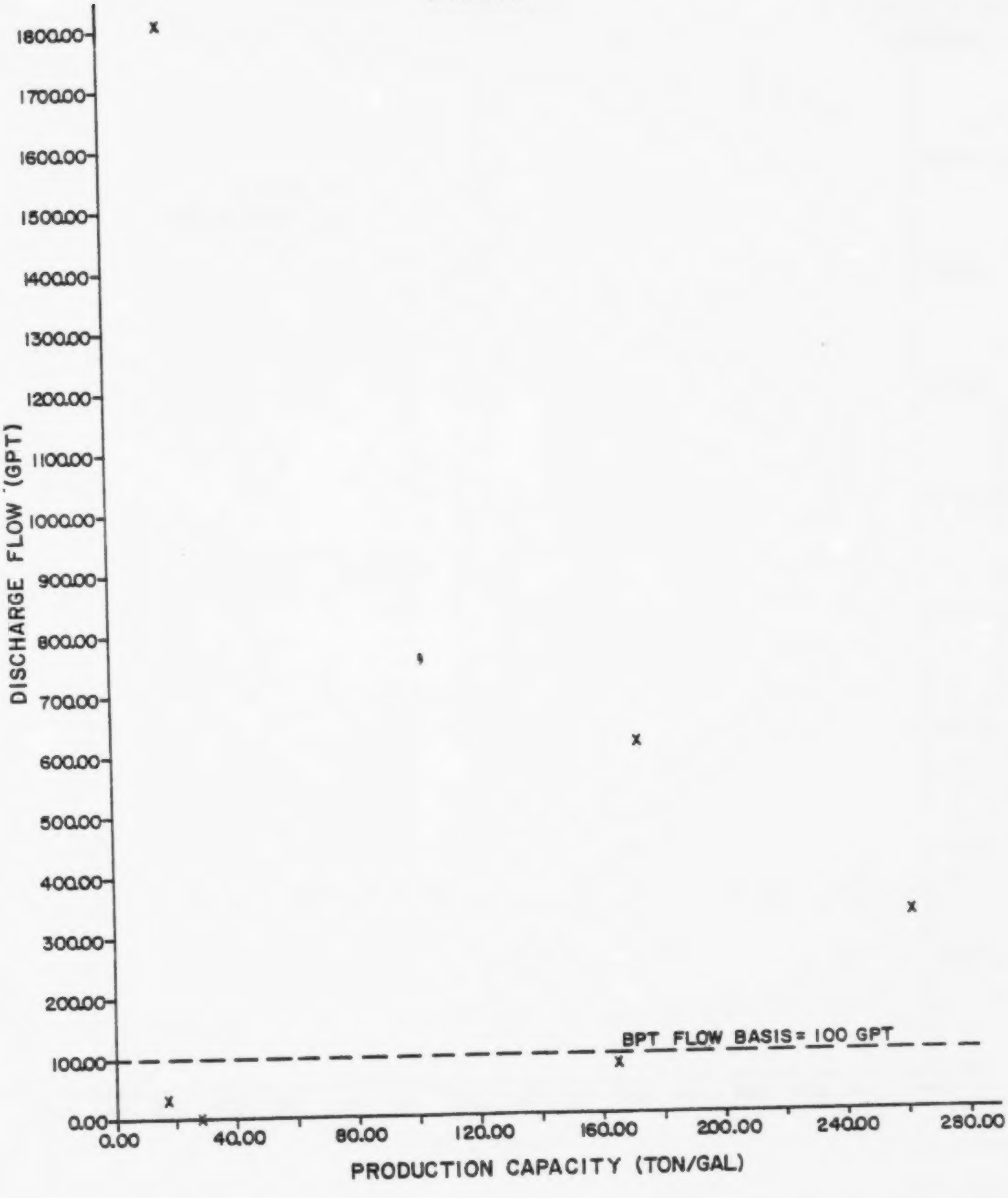


FIGURE IV-3
SCALE REMOVAL SUBCATEGORY
KOLENE

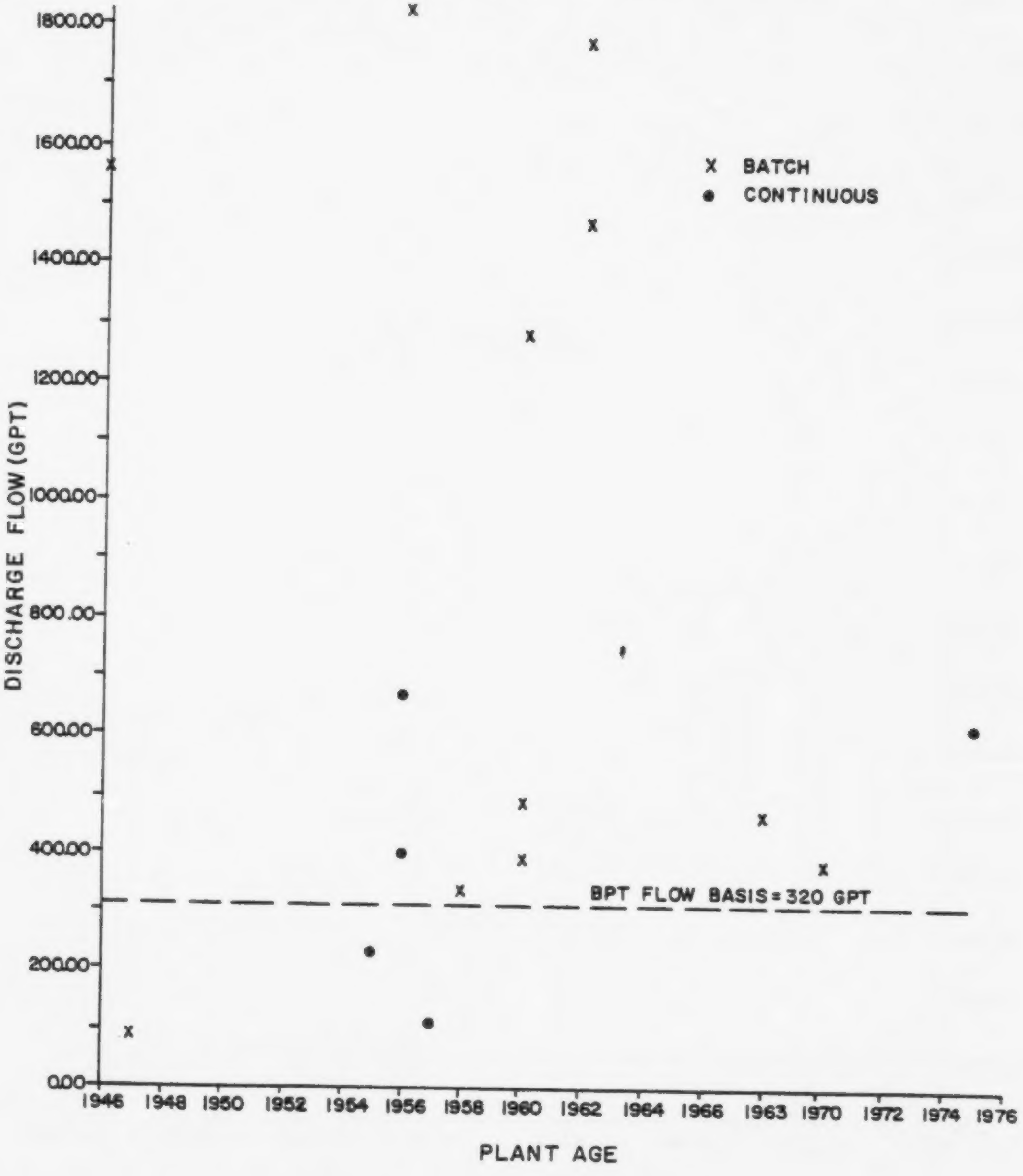
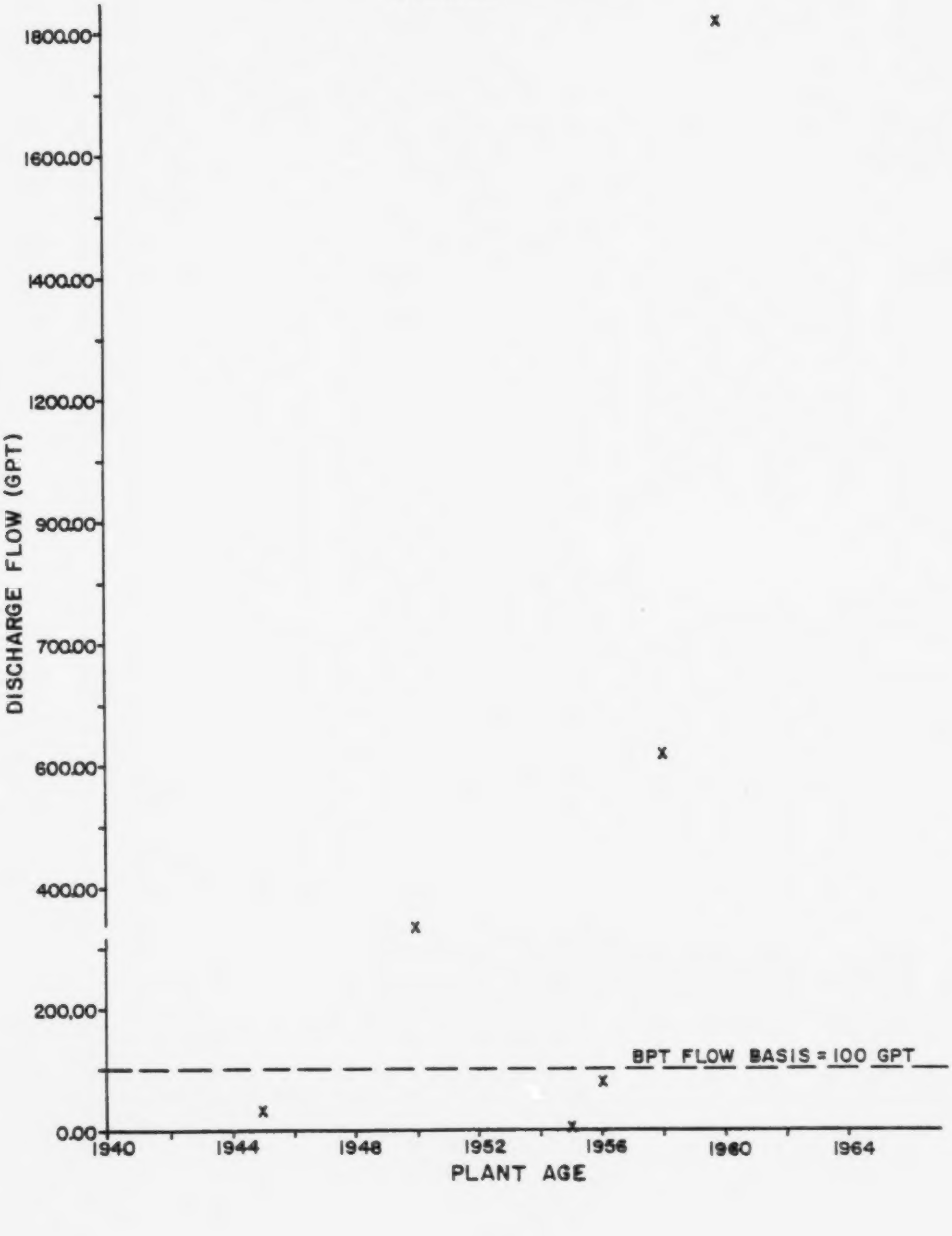


FIGURE IV-4
SCALE REMOVAL SUBCATEGORY
HYDRIDE



SCALE REMOVAL SUBCATEGORY

SECTION V

WATER USE AND WASTE CHARACTERIZATION

Introduction

Process water use is a major factor in estimating pollutant loads and pollutant removal costs. The importance of careful control of process water usage cannot be overemphasized. Data from sampling surveys and the DCP responses were used to evaluate process water use and to obtain total wastewater volumes. Control and treatment technology in place and operating was identified for each line, and the ultimate disposal of wastewater was examined. The origins and characteristics of scale removal operations are reviewed below.

The wastewater characterization for kolene scale removal operations is based upon data obtained during field sampling programs conducted at five batch and two continuous kolene scale removal facilities. Two of the batch facilities and one of the continuous facilities were visited during the original study. The two batch facilities were visited again during this study. In these instances, the more recent data are used for the purpose of wastewater characterization. During this study sampling was conducted for the previously limited pollutants, as well as for toxic pollutants.

To provide the data needed to characterize hydride scale removal operations field sampling programs were conducted at three plants. One of these plants was visited during the original study. One plant has both hydride and batch type kolene scale removal operations.

Description of Scale Removal Operations and Wastewater Sources

A. Kolene Descaling

As shown in Figures III-1 and III-2, descaling is performed in both batch and continuous operations and the scale removal operation is used in conjunction with pickling. However, only the wastewaters generated in the kolene operation are considered herein.

Wastewaters are generated at two points in the kolene descaling operation; the salt bath tank and in the subsequent quench or rinse steps. The bath is a molten salt solution that contains high levels of sodium compounds together with other constituents. The same solution is kept in the bath for a long time and is used to process a large tonnage of product before being replaced. One company reported replacing the salt bath in one line only twice in 17 years.

After the same bath has been used for some time it becomes highly contaminated with scale from the steel, oils that are burned off in the high temperature bath, metals and other compounds. When a certain level of contamination is reached, the descaling properties of the bath diminish to a point where it must either be replenished or replaced with fresh solutions. Because of the highly contaminated nature of the salt solution and because of its relatively small volume, this waste is generally hauled off-site by private contractors. These salt solutions are treated at some lines by bleeding a small volume of the wastes into treatment system over a period of hours or days. The waste kolene solutions are not disposed of in this manner at any of the lines sampled for this study.

The other source of wastewater in the kolene operation is the discharge from the quench or rinse step that follows the scale removal operation. This discharge is studied herein and all flow rates and wastewater characteristics referred to in this report pertain to this source.

After treatment in the heated kolene solution, it is necessary to rinse the product. Rinsing satisfies four objectives: (1) removing salt solution "carried over" from the kolene bath; (2) halting the action of the salt solution on the surface of the product, (3) inducing a thermal shock which helps "break" the scale on the surface of the process material; and, (4) cooling the product to reduce its temperature to a safe level prior to pickling.

Fresh, cool water is continually added to the tanks, if possible, to keep the temperature of the water in the rinse tank fairly constant and relatively clean. Thus, there is usually a continuous discharge from the quench or rinse tanks. Wastewaters generated in the quench and rinse steps contain significant levels of solids, and total and hexavalent chromium and have elevated pH and temperature levels. The quality of the rinse water may vary greatly depending on the age of the salt solution in the kolene bath, the amount of carry-over of solution into the rinse tank and the amount of product processed. To minimize the amount of carry-over, the product is usually held over the salt bath (in batch operations) for some time after it has been immersed to insure drainage of solution from the process material.

Flow data and net raw waste loads for the pollutants are presented in Table V-1 for kolene scale removal operations. Toxic pollutant data are presented only for those pollutants detected in the raw waste at levels greater than 0.010 mg/l above water intake levels. Net concentration data were used to describe the actual levels of pollutants added in kolene scale removal operations. However, the proposed limitations were developed on a gross basis because the effect of pollutants present in water intake is insignificant

B. Hydride Descaling

As hydride descaling is carried out in the same manner as kolene scale removal, the general process flow diagrams for scale removal (Figures III-1 and 2) also apply to hydride operations. The only significant difference between kolene and hydride descaling is in the salt solutions used. While the compounds in the kolene bath act as extremely strong oxidizing agents, the hydride salt solution depends on the strong reducing properties of sodium hydride to aid in scale removal. Otherwise, the two descaling processes are very similar.

Because of the many similarities, the discussion presented above for the kolene operations also applies to hydride operations. In fact, the operations are so similar that many lines that previously used hydride solutions have been converted to kolene operations with only minor modifications.

Because of the different salt solution used in the hydride process, the flow and wastewater characteristics are significantly different from those of the kolene operations. The flow rate, which averages about 100 gal/ton, is significantly less than the flow rate for kolene operations. Many of the same pollutants are found in the wastewaters from both processes, but generally, they are found at different levels. In addition, cyanide is sometimes generated in the hydride process while no significant levels of cyanide were found in the discharges from the kolene operations. Net raw waste data are presented in Table V-2 for hydride operations. As previously mentioned, only those toxic pollutants found at levels greater than 0.010 mg/l are included in this table.

TABLE V-1

CONCENTRATION OF POLLUTANTS IN NET RAW WASTEWATER[1]
KOLENE OPERATIONS

	Reference No.	424-01	176-04	440A-01	432K	684D	
	Plant Code	131	132	138	137	Q	
	Sample Points	B-A	H-A	B-A	B-A	13-10	Average[2]
	Flow (Gal/Ton)	494	461	342	280	108	337
	Type of Mill	Batch	Batch	Batch	Cont.	Cont.	
	Suspended Solids	119	651	191	1219	231	482
	Chromium, Hexavalent	124	261	79.5	NR	424	222
	Dissolved Iron	NA	ND	-	-	-	N/A
	pH (Units)	8.2	7.8	7.3	7.3	7.2	7.2-8.2
023	Chloroform	-	0.031	ND	-	NA	0.0078
044	Methylene Chloride	ND	0.231	0.115	-	NA	0.087
066	Bis-(2-ethylhexyl) phthalate	0.435	0.038	ND	0.129	NA	0.151
067	Butyl benzyl phthalate	ND	0.01	ND	-	NA	0.0025
114	Antimony	NA	NA	-	0.108	NA	0.054
115	Arsenic	0.022	NA	NA	0.012	NA	0.017
118	Cadmium	ND	0.01	ND	ND	0.02	0.006
119	Chromium	33.7	365	102	36.3	440	195
120	Copper	ND	4.73	0.03	0.812	0.01	1.116
122	Lead	ND	0.03	ND	NA	ND	0.008
123	Mercury	NA	NA	NA	ND	0.03	0.015
124	Nickel	-	37.5	0.790	1.08	0.03	7.88
125	Selenium	0.021	NA	NA	0.06	ND	0.027
127	Thallium	NA	NA	NA	0.155	NA	0.155
128	Zinc	NA	NA	ND	0.087	-	0.029

---

(1) All values are in mg/l unless otherwise noted.
(2) Negative values counted as zero in average.

- : Negative value.
ND : Not detected.
NA : Not analyzed.
N/A: Not applicable.

TABLE V-2

CONCENTRATIONS OF POLLUTANTS IN THE NET RAW WASTEWATERS(1)
HYDRIDE OPERATIONS

					Average(2)
	Reference No.	176-01	256N-01	440A	
	Plant Code	132	139	L	
	Sample Point(s)	O-A	B-A	(9-11)	
	Flow, gal/ton	611	1.8	1200	604
	Suspended Solids	465	388	370	408
	Dissolved Iron	0.415	36.5	0.36	12.4
	pH, units	7.8	8.2	9.5	7.8-9.5
22	Parachlorometacresol	0.012	ND	NR	*
65	Phenol	ND	0.013	NR	*
66	Bis-(2-ethylhexyl) Phthalate	0.018	0.056	NR	0.037
114	Antimony	NR	0.65	NR	0.65
118	Cadmium	ND	0.11	NR	0.055
119	Chromium	15.3	1.47	ND	5.26
120	Copper	0.65	0.48	ND	0.378
121	Cyanide	ND	ND	0.106	0.0353
122	Lead	0.2	1.05	ND	0.417
124	Nickel	8.68	0.29	ND	2.99
125	Selenium	NR	0.025	ND	0.0125
126	Silver	ND	0.095	NR	0.0475
128	Zinc	0.045	0.18	-	0.075

---

(1) All values are in mg/l unless otherwise noted.
(2) Negative values counted as zero in average.

* : Value less than 0.01 mg/l
- : Negative value
ND: Not detected
NR: Not reported

SCALE REMOVAL SUBCATEGORY

SECTION VI

WASTEWATER POLLUTANTS

Introduction

A general discussion of the process used in selecting the pollutants to be limited is included in Section V of Volume I.

Rationale for the Selection of Wastewater Pollutants

Wastewaters are generated in scale removal operations as a result of the quenching or rinsing of the steel product following its immersion in the salt bath. These waters become contaminated with both the materials present on the product surface and any salt solution carried over from the process. Tables VI-1 and VI-2 list all pollutants found at concentrations greater than 0.010 mg/l at any plant, or reported as being present in the DCP responses for kolene and hydride descaling, respectively. The Agency believes that the phthalates are artifacts and thus are not considered representative of scale removal wastewaters. Tables VI-3 and VI-4 list all pollutants found in an average concentration (of all sampled plants) greater than 0.010 mg/l for kolene and hydride descaling, respectively. These pollutants are considered representative of scale removal wastewaters. In the original guidelines, the same six pollutants were chosen from these lists to be limited for both kolene and hydride scale removal processes. The pollutants are: total suspended solids, dissolved iron, hexavalent chromium, dissolved chromium, cyanide and pH. However, additional data gathered during this study indicate changes are warranted in the selection of pollutants.

Kolene Scale Removal

Cyanide, a pollutant which was originally considered characteristic of kolene wastewaters, has not been selected as the additional data gathered during this study indicate that cyanide is not found at significant levels. Also, instead of developing limitations for dissolved chromium, the Agency is proposing limitations for total chromium. This change was brought about mainly due to the designation of total chromium as a "toxic" pollutant.

Hexavalent and total chromium are included on the list of characteristic pollutants for kolene scale removal operations as there are significant levels of these pollutants in kolene scale removal wastewaters. The presence of chromium (hexavalent and total) and the other toxic metals in kolene wastewaters is attributable to the aggressive nature of the salt bath in attacking the product surface. Chromium is not only released from the product by the kolene, but it is also an inherent component of the kolene salt bath. The various metals also comprise a portion of the suspended solids generated in the process wastewaters. The suspended solids are present in kolene wastewaters primarily due to the pickup of the scale and other materials on the surface of the product. The limitations for pH reflect a range within which environmental damage is avoided. In order to accomplish the desired level of treatment, process wastewaters require two pH adjustments: one for the hexavalent chromium treatment process, and the other as a neutralization prior to discharge.

Hydride Scale Removal

For hydride operations, the Agency is proposing limitations for total chromium in lieu of hexavalent chromium. Hexavalent chromium was not found in wastewaters from hydride operations.

Unlike the kolene wastewaters, cyanide is characteristic of hydride wastewaters. The presence of cyanide is the result of the addition of a carbon source (such as charcoal) to the hydride salt bath. The temperature and chemical makeup of the salt bath are such that cyanide can be generated when the carbon source is added. The industry reports that under certain operating conditions high levels of cyanide can be generated in the hydride bath. Hence, alkaline chlorination has been installed at several hydride plants as treatment for cyanide. The total suspended solids are primarily comprised of the various scale and other matter carried over into the rinse/quench tanks by the product. The selection of pH was necessitated by the need to neutralize hydride scale removal operation wastewaters.

TABLE VI-1

POLLUTANTS KNOWN TO BE PRESENT KOLENE SCALE REMOVAL

Total Suspended Solids
pH
Dissolved Iron
Hex. Chromium

023	Chloroform
024	2 - Chlorophenol
030	1,2 - Trans-Dichloroethylene
044	Methylene Chloride
057	2 - Nitrophenol
065	Phenol
066	BIS (2 - Ethylhexyl) Phthalate
068	Di-n-Butyl Phthalate
069	Di-n-Octyl Phthalate
073	Benzo (a) Pyrene
085	Tetrachloroethylene
114	Antimony
115	Arsenic
117	Beryllium
118	Cadmium
119	Chromium
120	Copper
122	Lead
124	Nickel
125	Selenium
126	Silver
127	Thallium
128	Zinc

TABLE VI-2

POLLUTANTS KNOWN TO BE PRESENT HYDRIDE SCALE REMOVAL

Total Suspended Solids
pH
Dissolved Iron
Hex. Chromium

022	Parachlorometa Cresol
034	2, 4 - Dimethylphenol
044	Methylene Chloride
064	Pentachlorophenol
065	Phenol
066	Bis (2 - Ethylhexyl) Phthalate
068	Di-n-Butyl Phthalate
070	Diethyl Phthalate
071	Dimethyl Phthalate
114	Antimony
118	Cadmium
119	Chromium
120	Copper
121	Cyanide
122	Lead
124	Nickel
125	Selenium
126	Silver
128	Zinc

TABLE VI-3

SELECTED POLLUTANTS KOLENE SCALE REMOVAL

Total Suspended Solids
pH
Dissolved Iron
Hex. Chromium

023	Chloroform
114	Antimony
115	Arsenic
118	Cadmium
119	Chromium
120	Copper
124	Nickel
125	Selenium
127	Thallium
128	Zinc

TABLE VI-4

SELECTED POLLUTANTS HYDRIDE SCALE REMOVAL

Total Suspended Solids
pH
Dissolved Iron
Hex. Chromium

114	Antimony
118	Cadmium
119	Chromium
120	Copper
121	Cyanide
122	Lead
124	Nickel
125	Selenium
126	Silver
128	Zinc

SCALE REMOVAL SUBCATEGORY

SECTION VII

CONTROL AND TREATMENT TECHNOLOGY

Introduction

This section presents the treatment practices currently used within the scale removal subcategory. Also included are a summary of the sampling data for kolene and hydride operations and a description of the treatment practiced at each line. The data show the range of treatment practiced within this subcategory and the range of effluent quality achieved with the various treatment systems.

In order to develop the proposed BPT, BAT, BCT, PSES and PSNS effluent limitations, the Agency examined the levels of treatment that exist within the subcategory. The different technology levels were then formulated in an "add-on" fashion to the basic levels of treatment. Only New Source Performance Standards were not developed in this manner since NSPS apply to new scale removal operations. The alternative treatment systems and corresponding effluent characteristics are presented in Sections IX through XIII.

The Agency developed the proposed effluent limitations and standards on the basis of a review of effluent data obtained during plant visits and, in the case of certain advanced technologies, on the proven capabilities of those systems. Treatment system summaries, schematics and effluent data for the visited plants are presented in this section.

Control and Treatment Technologies - Scale Removal

Summary of Treatment Practices Currently Employed at Kolene Descaling Operations

The wastewater control and treatment technologies currently used at kolene descaling operations vary considerably. However, similar components are used to attain reductions in the levels of certain pollutants. Based upon data from the DCPs and the plant visits, the following summary of disposal and treatment technologies was developed for this subcategory.

All treatment systems installed at kolene operations include physical/chemical controls. Also, over 60% of the operations which provide treatment use central treatment systems (i.e., other wastewaters are combined with the descaling wastewaters prior to treatment). These central treatment systems are generally designed primarily to reduce the levels of suspended solids and metals and to neutralize the pH of the discharge. The data for this and other subcategories were analyzed to determine the effect central treatment systems on the ability to achieve the proposed limitations and standards. This analysis found that similar flow rates and effluent levels are achievable with both separate and central treatment systems and, thus, different limitations and standards are not proposed for separate and central treatment systems.

Many of the kolene descaling operation treatment facilities provide sufficient treatment to achieve acceptable effluent quality for discharge to a receiving stream, while others provide only limited pretreatment prior to the discharge of wastewaters to a publicly owned treatment works (POTWs). Additionally, no treatment is proposed for three kolene descaling operations.

Following is a summary of treatment technologies currently practiced at kolene descaling operations. The discussion on the technologies, with the exception of chromium reduction, is equally applicable to hydride descaling operations.

Chromium Reduction

Chromium is an inherent component of the kolene salt bath. In addition, chromium contained in the steel is released and discharged in large quantities in the rinse waters. Most of the chromium present in the raw wastewaters is in the hexavalent (+6) state. Because of the toxicity of this pollutant, treatment facilities are provided at most kolene operations to reduce levels of hexavalent chromium prior to discharge. The most widely used method to reduce the levels of Cr(+6) is chemical reduction. The chemical reduction process proceeds in the following manner. The wastewaters from the quench or rinse tanks is treated with acid to lower the pH to the range of 2 to 4 standard units, which is the optimum range for the reduction of Cr (+6) to Cr (+3). A reducing agent such as gaseous sulfur dioxide is then added and the wastewaters are agitated in a mixing tank. The combination of the low pH and the action of the reducing agent reduces the chromium from the hexavalent state to the trivalent state. The chromium in this form can then be readily precipitated in subsequent chemical treatment steps with maximum precipitation achieved at a pH near 8.5

Neutralization

After the chromium is reduced to its trivalent form at a low pH, the wastewaters at most lines are neutralized to bring the pH above 7 where optimum metal removal will occur in subsequent steps. If central treatment is practiced, neutralization can sometimes be achieved by mixing the acidic scale removal wastes with alkaline wastes from other sources which are compatible for treatment. Wastes from kolene lines with central treatment systems are neutralized in this manner. If alkaline waste streams are not available or if descaling wastes are treated separately, a neutralizing agent is needed. Either lime or caustic is used at the kolene lines surveyed. Enough lime or caustic is added to raise the pH above 7 which is the optimum range for the precipitation of the metals in the descaling mills waste stream.

Precipitation and Clarification

Chemical additions are made at over 90% of the kolene lines to aid precipitation, with polymers being the flocculant most often used. From the chemical addition step, neutralized wastewaters enter clarification facilities. For kolene operations, three types of clarification facilities are used; settling lagoons, thickeners and clarifiers. Clarifiers are in use at 83% of the kolene mills. The remaining 17% use either thickeners or settling lagoons.

Solid Waste Processing

The final treatment step involves processing suspended solids collected in the final clarification. Depending on the type of neutralizing agent used, various types and volumes of sludge are generated. As much as 10 tons of sludge per day can be generated at a large kolene descaling operation. Sludge is dewatered by vacuum filtration or centrifugation with vacuum filtration being the more common technology.

Summary of Treatment Practices Currently Employed at Hydride Descaling Operations

As in the case of the kolene descaling operations, wastewaters are generated in hydride descaling operations as a result of the quenching or rinsing of the product following the scale removal process. Because of differences in the wastewaters, the use of different treatment configurations is necessary. There is very little hexavalent chromium released in the hydride process, therefore, chromium reduction treatment steps are not required. However, due to the nature of the hydride process, there is the potential for the generation of significant levels of cyanide under certain operating conditions. As a result, most lines have a cyanide treatment step, with alkaline chlorination being the most common.

After the cyanide has been destroyed in this pretreatment step, wastewater treatment is similar to that for kolene operations. The wastewaters are neutralized with acid to lower the pH, a polymeric flocculant is added, and then clarification is carried out to remove the solids and metals precipitated in the process. All hydride operations that provide treatment and have direct discharges treat wastewaters in central treatment systems. Also, one line reuses waters from the central treatment system.

Control and Treatment Technologies Considered for Toxic Pollutant Removal

The advanced treatment alternatives considered for kolene or hydride scale removal operations, and a short description of each, are presented below. These systems have been demonstrated in varying degrees in the scale removal subcategory and in other industrial applications on wastewaters with similar characteristics. The treatment systems are discussed in greater detail in later sections with special emphasis on the applicability to the scale removal subcategory.

Filtration

This technology is employed to remove the particulate toxic metals loadings. Filtration can be used as a last major component in a treatment system or may be used for pretreatment prior to treatment in another component (such as adsorption on activated carbon). Metals removal is accomplished by passing the wastewater stream, either under pressure or by gravity, through a filter media. The filter media, generally sand, anthracite coal or garnet, permits water passage but prevents the passage of a major portion of the particles suspended in the wastewater. The filter media itself can be comprised of a single type and size, various sizes of the same media, or a mixed media which contains several types and sizes.

The collected solids are removed from a filter by periodic backwashings, with the backwash commonly discharged to the treatment system influent. The backwash procedure involves the pumping of filter effluent through the filter in a direction opposite that of its operational flow direction. The backwash process usually begins with air agitation to both mix and scour the filter media. By returning the backwash to the system influent (with polymer addition), filtered solids contained in the backwash are removed by sedimentation in the treatment system. Filtration is used in many steel industry applications.

Sulfide Precipitation

Wastewater treatment systems which have a sulfide compound addition component have been shown to be capable of reducing effluent metals concentrations below levels usually achieved in lime precipitation reactions. Some of the metals which can effectively be precipitated with sulfide are zinc, copper, chromium, nickel, lead and silver which are all inorganic toxic pollutants. The increased removal efficiencies can be attributed to the comparative solubilities of metal sulfides and metal hydroxides. Iron sulfide is often used to achieve the precipitation because this compound has a solubility which exceeds that of the heavy metal sulfides to be precipitated and because this compound does not form excessive levels of sulfide ion concentrations which could contribute to the formation of hydrogen sulfide, an objectional gas. The typical sulfide precipitation systems consists of neutralization, precipitation and a polishing filter. Refer to Volume I for additional information pertaining to sulfide treatment.

Vapor Compression Distillation (Evaporation)

Vapor compression distillation is typically used to concentrate a high dissolved solids wastestream (3,000-10,000 mg/l) to a slurry consistency (approximately 100,000 mg/l). The slurry discharge can be dried in a mechanical drier or allowed to crystallize in a small solar or steam-heated pond prior to final disposal. The distillate quality water generated by this system can be recycled back to the scale removal operation thereby eliminating discharges. One desirable feature of this unit is its relative freedom from scaling. Because of the unique design of the system, calcium sulfate and silicate crystals grow in solution as opposed to depositing on heat transfer surfaces. Economic operation requires a high calcium to sodium ratio (hard water). Due to economic considerations, only limited application is made of vapor compression distillation in processing wastewater.

The installation of this type of unit may be the only possible way to achieve a zero discharge of process water at scale removal operations. However, energy and cost considerations preclude widespread use of this technology.

Plant Visit Data

Table VII-1 provides a legend for the various control and treatment technology abbreviations used in the following tables and in other tables throughout this report. Table VII-2 presents a summary of raw and treated effluent data for kolene operations visited during the original guidelines survey. Table VII-3 presents a summary of raw and treated effluent data for kolene operations visited during the toxic pollutants survey. Tables VII-4 and VII-5 present similar data for hydride operations.

Plant Visits - Kolene Descaling Operations

The Agency conducted a total of seven field sampling visits at five kolene descaling operations. Three visits were conducted during the original study and four visits were conducted during this study. Two of the originally visited plants were visited again during this study. A brief description of each wastewater treatment facility follows. More details are available on the respective wastewater flow diagram for each plant.

Line L - Figure VII-1

The process rinse water from this batch kolene operation is treated in a neutralization tank prior to discharge to a municipal treatment facility.

Line C - Figure VII-2

At the time of the initial survey, no treatment was provided.

Line Q - Figure VII-3

No treatment was provided at the time of the inital survey.

Line 131 - Figure VII-4

Line 131 and line Q described above are the same. Since the time of the initial survey, a treatment facility has been installed. At the time of sampling, the treatment system was not yet operating so a synthetic sample was generated by plant personnel for analysis. Treatment now installed consists of chromium reduction, neutralization with lime and other wastes, settling in a clarifier and final settling in a polishing lagoon. Sludges generated in the process are dewatered with vacuum filters.

Line 132 - Figure VII-5

The wastes from this batch operation are treated in a central treatment system with wastes from several other sources. Treatment consists of chromium reduction, neutralization with acid or caustic depending on the wastes being treated, flocculation with polymer, and clarification with oil skimming. Sludges are dewatered in cyclones.

Line 137 - Figure VII-6

The continuous kolene operation wastewaters are treated in a central treatment system. The kolene wastes represent approximately 1.5% of the total flow to the treatment system. Treatment consists of lime neutralization and sedimentation in a settling lagoon. The discharge is directed to a receiving stream.

Line 138 - Figure VII-7

Line 138 is the same mill as Mill L described above. No changes in treatment were noted between surveys.

Plant Visits - Hydride Descaling Operations

Three field sampling vists were conducted at hydride descaling operations; one visit during the original study and two visits during this study. One of the lines visited during this study also had a kolene descaling operation. A brief description of each wastewater treatment system follows.

Line L - Figure VII-8

The hydride process rinse waters are discharged to a municipal treatment system after these wastes are mixed with other process water.

Line 132 - Figure VII-5

The wastewaters from this hydride operations are treated in a central treatment system with wastewaters from several other sources. Treatment consists of neutralization with lime or acid depending on the wastewaters being treated, flocculation and polymer, and clarification with oil skimming. Sludges are dewatered in cyclones.

Line 139 - Figure VII-9

Hydride descaling wastewaters are treated by alkaline chlorination, neutralization with acid and settling prior to discharge to a POTW.

TABLE VII-1

OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS

Symbols

A. Operating Modes

1. OT Once-Through

2. Rt,s,n Recycle, where t = type waste
s = stream recycled
n = % recycled

t: U = Untreated
T = Treated

	s	n
P	Process Wastewater	% of raw waste flow
F	Flume Only	% of raw waste flow
S	Flume and Sprays	% of raw waste flow
FC	Final Cooler	% of FC flow
BC	Barometric Cond.	% of BC flow
VS	Abs. Vent Scrub.	% of VS flow
FH	Fume Hood Scrub.	% of FH flow

3. REt,n Reuse, where t = type
n = % of raw waste flow

t: U = before treatment
T = after treatment

4. BDn Blowdown, where n = discharge as % of raw waste flow

B. Control Technology

10. DI Deionization

11. SR Spray/Fog Rinse

12. CC Countercurrent Rinse

13. DR Drag-out Recovery

C. Disposal Methods

20. H Haul Off-Site

21. DW Deep Well Injection

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS
PAGE 2

C. Disposal Methods (cont.)

22.	Qt,d	Coke Quenching, where t = type d = discharge as % of makeup t: DW = Dirty Water CW = Clean Water
23.	EME	Evaporation, Multiple Effect
24.	ES	Evaporation on Slag
25.	EVC	Evaporation, Vapor Compression Distillation

D. Treatment Technology

30.	SC	Segregated Collection
31.	E	Equalization/Blending
32.	Scr	Screening
33.	OB	Oil Collecting Baffle
34.	SS	Surface Skimming (oil, etc.)
35.	PSP	Primary Scale Pit
36.	SSP	Secondary Scale Pit
37.	EB	Emulsion Breaking
38.	A	Acidification
39.	AO	Air Oxidation
40.	GF	Gas Flotation
41.	M	Mixing
42.	Nt	Neutralization, where t = type t: L = Lime C = Caustic A = Acid W = Wastes O = Other, footnote

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS
PAGE 3

D. Treatment Technology (cont.)

43. FLt Flocculation, where t = type

t: L = Lime
A = Alum
P = Polymer
M = Magnetic
O = Other, footnote

44. CY Cyclone/Centrifuge/Classifier

44a. DT Drag Tank

45. CL Clarifier

46. T Thickener

47. TP Tube/Plate Settler

48. SLn Settling Lagoon, where n = days of retention time

49. BL Bottom Liner

50. VF Vacuum Filtration (of e.g., CL, T, or TP underflows)

51. Ft,m,h Filtration, where t = type
m = media
h = head

t	m	h
D = Deep Bed	S = Sand	G = Gravity
F = Flat Bed	O = Other, footnote	P = Pressure

52. CLt Chlorination, where t = type

t: A = Alkaline
B = Breakpoint

53. CO Chemical Oxidation (other than CLA or CLB)

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS
PAGE 4

D. Treatment Technology (cont.)

54.	BOt	Biological Oxidation, where t = type t: An = Activated Sludge n = No. of Stages T = Trickling Filter B = Biodisc O = Other, footnote
55.	CR	Chemical Reduction (e.g., chromium)
56.	DP	Dephenolizer
57.	ASt	Ammonia Stripping, where t = type t: F = Free L = Lime C = Caustic
58.	APt	Ammonia Product, where t = type t: S = Sulfate N = Nitric Acid A = Anhydrous P = Phosphate H = Hydroxide O = Other, footnote
59.	DSt	Desulfurization, where t = type t: Q = Qualifying N = Nonqualifying
60.	CT	Cooling Tower
61.	AR	Acid Regeneration
62.	AU	Acid Recovery and Reuse
63.	ACt	Activated Carbon, where t = type t: P = Powdered G = Granular
64.	IX	Ion Exchange
65.	RO	Reverse Osmosis
66.	D	Distillation

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT
TECHNOLOGIES AND DISPOSAL METHODS
PAGE 5

D. Treatment Technology (cont.)

67.	AAl	Activated Alumina
68.	OZ	Ozonation
69.	UV	Ultraviolet Radiation
70.	CNTt,n	Central Treatment, where t = type n = process flow as % of total flow t: 1 = Same Subcats. 2 = Similar Subcats. 3 = Synergistic Subcats. 4 = Cooling Water 5 = Incompatible Subcats.
71.	On	Other, where n = Footnote number
72.	SB	Settling Basin
73.	AE	Aeration
74.	PS	Precipitation with Sulfide

TABLE VII-2

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES SURVEY
KOLENE

Raw Wastewaters

	Reference Code	440A-01		424-01		684D			
	Plant Code	L		C		Q			
	Sample Point	8		9		13		Average(1)	
	Flow (GPT)	398		494		108		333.3	
		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	433	0.72	103	0.21	244	0.11	260	0.35
	Chromium Hexavalent	100.0	0.17	ND	ND	424	0.19	174.7	0.12
	pH (Units)	12.2	N/A	12.0	N/A	13.1	N/A	12.0-13.1	N/A
023	Chloroform	NR	NR	NR	NR	NR	NR	NR	NR
114	Antimony	NR	NR	NR	NR	NR	NR	NR	NR
115	Arsenic	NR	NR	NR	NR	NR	NR	NR	NR
118	Cadmium	ND	ND	ND	ND	0.02	Neg.	0.007	Neg.
119	Chromium	115.5	0.19	ND	ND	440	0.20	185.2	0.13
120	Copper	0.01	0.000017	ND	ND	0.03	0.000014	0.013	0.00001
124	Nickel	0.01	0.000017	0.07	0.00014	0.03	0.000014	0.037	0.00006
125	Selenium	ND	ND	ND	ND	ND	ND	ND	ND
127	Thallium	NR	NR	NR	NR	NR	NR	NR	NR
128	Zinc	0.001	Neg.	0.002	Neg.	0.018	Neg.	0.007	Neg.

TABLE VII-2
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES SURVEY
KOLENE
PAGE 2

Treated
Effluents

	Reference Code	440A-01		424-01		684D	
	Plant Code	L		C		Q	
	Sample Point	8		9		13	
	Flow (GPT)	398		494		108	
	C&TT	NW,SL		VF,CR,FLP,NL,NW,NA,CL,SL,T		Not Available	
		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	433	0.72	103	0.21	244	0.11
	Chromium Hexavalent	100.0	0.17	ND	ND	424	0.19
	pH (Units)	12.2	N/A	12.0	N/A	13.1	N/A
023	Chloroform	NR	NR	NR	NR	NR	NR
114	Antimony	NR	NR	NR	NR	NR	NR
115	Arsenic	NR	NR	NR	NR	NR	NR
118	Cadmium	ND	ND	ND	ND	0.02	Neg.
119	Chromium	115.5	0.19	ND	ND	440	0.20
120	Copper	0.01	0.000017	ND	ND	0.03	0.000014
124	Nickel	0.01	0.000017	0.07	0.00014	0.03	0.000014
125	Selenium	ND	ND	ND	ND	ND	ND
127	Thallium	NR	NR	NR	NR	NR	NR
128	Zinc	0.001	Neg.	0.02	Neg.	0.018	Neg.

---

(1) Values which are listed as ND are included in calculating averages as zero. Values which are listed as NR are not included.

N/A : Not applicable.
ND : Not detectable.
NR : Not reported.
Neg.: Negligible, load is less than 0.00001 lbs/1000 lbs.

TABLE VII-3

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
KOLENE

Raw Wastewater

	Reference Code	424-01		176-04		440A-01		432K		Average(1)		Overall(2) Average	
	Plant Code	131		132		138		137		394		368	
	Sample Point	B		H		B		B					
	Flow (GPT)	494		461		342		280					
	Mill Type	Batch		Batch		Batch		Cont.					
		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	124	0.26	678	1.30	194	0.28	1228	1.43	556	0.82	429.1	0.62
	Chromium Hexavalent	124	0.26	262	0.5	79.5	0.13	NR	NR	155.2	0.30	164.9	0.21
	pH (Units)	12.6	N/A	12.4	N/A	11.7	N/A	13.0	N/A	11.7-13.0	N/A	11.7-13.1	N/A
023	Chloroform	ND	ND	0.041	0.000079	ND	ND	0.015	0.000018	0.014	0.000020	0.014	0.000030
114	Antimony	0.021	0.00004	0.45	0.00087	0.10	0.00014	0.14	0.00016	0.18	0.00030	0.18	0.00035
115	Arsenic	0.03	0.00006	NR	NR	NR	NR	0.019	0.000022	0.027	0.000050	0.030	0.000060
118	Cadmium	0.14	0.00029	0.02	0.000038	0.01	0.000014	0.20	0.00023	0.093	0.00014	0.066	0.00012
119	Chromium	367	0.76	365	0.70	102	0.15	36.7	0.043	217.6	0.41	203.7	0.291
120	Copper	0.133	0.00027	4.75	0.0091	0.05	0.000071	0.88	0.0010	1.45	0.0026	0.84	0.0015
124	Nickel	0.77	0.0016	37.5	0.072	0.86	0.0012	1.67	0.0020	10.03	0.019	5.84	0.011
125	Selenium	0.027	0.000056	NR	NR	NR	NR	0.069	0.000081	0.038	0.000060	0.024	0.000024
127	Thallium	0.065	0.00013	NR	NR	NR	NR	0.21	0.00024	0.10	0.00016	0.10	0.00013
128	Zinc	0.18	0.00037	0.080	0.00015	0.020	0.000029	0.34	0.00039	0.15	0.00023	0.091	0.00013

TABLE VII-3
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
KOLENE
PAGE 2

	Treated Effluent								
	Reference Code	424-01		176-04		440A-01		432K	
	Plant Code	131		132		138		137	
	Sample Point	C		$\frac{H(90)}{X(769)}$ ZZ(772)		B		D	
	Flow (GPT)	494		461		342		280	
	Mill Type	Batch		Batch		Batch		Cont.	
	C&TT(5)	VF,CR,FLP,NL, NW,NA,CL,SL,T		CNT(17),CR,PSP,NA, CO,CLA,EB,FLP,NL NW,SL,CL,SSP,T,SS,CY		NW,SL		NL,SL	
		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Soldis	49.5	0.10	16.5	0.054	194	0.28	91.7	0.11
	Chromium Hexavalent	(3)	(4)	0.042	0.53	79.5	0.13	NR	NR
	pH (Units)	9.4	N/A	7.6	N/A	11.7	N/A	6.2	N/A
023	Chloroform	0.14	0.00030	*	0.000050	ND	ND	0.065	0.000076
114	Antimony	0.20	0.00040	NR	NR	0.10	0.00014	0.038	0.000044
115	Arsenic	*	**	NR	NR	NR	NR	ND	ND
118	Cadmium	0.02	0.000040	*	0.000040	*	0.000014	0.20	0.00023
119	Chromium	15.0	0.031	0.18	0.026	102	0.15	2.67	0.0031
120	Copper	0.061	0.00012	0.05	0.00023	0.05	0.000071	0.15	0.00017
124	Nickel	0.28	0.00057	1.35	0.0072	0.84	0.0012	6.00	0.0070
125	Selenium	ND	ND	*	**	NR	NR	ND	ND
127	Thallium	0.050	0.00010	NR	NR	NR	NR	0.05	0.000058
128	Zinc	0.034	0.000070	0.04	**	0.020	0.000029	0.26	0.00031

---

(1) Values listed as ND are included in average calculations as zero. Values listed as NR are not included.
(2) Average of all values from VII-2 and VII-3.
(3) Values for hex-chromium determined to be unreliable.
(4) Calculations not made because of unreliable concentration value.
(5) For C&TT Code definitions, see Table VII-1.

* : Less than 0.010 mg/l.
** : Less than 0.00001 lbs/1000 lbs.
N/A: Not applicable.
NR : Not reported.
ND : Not detected.

TABLE VII-4

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HYDRIDE

Raw Wastewater

Reference Code	440A	
Plant Code	L	
Sample Point	9	
Flow (GPT)	1200	
	mg/1	lbs/1000 lbs
Suspended Solids	376	1.88
Dissolved Iron	0.36	0.0018
pH (Units)	11.9	N/A
114 Antimony	NR	NR
118 Cadmium	ND	ND
119 Chromium	ND	ND
120 Copper	ND	ND
121 Cyanide	0.11	0.00053
122 Lead	ND	ND
124 Nickel	ND	ND
125 Selenium	ND	ND
126 Silver	NR	NR
128 Zinc	ND	ND

Treated
Effluent

Reference Code	440A	
Plant Code	L	
Sample Point	9	
Flow (GPT)	1200	
C&TT(1)	NW,SL	
	mg/1	lbs/1000 lbs
Suspended Solids	376	1.88
Dissolved Iron	0.36	0.0018
pH (Units)	11.9	N/A
114 Antimony	NR	NR
118 Cadmium	ND	ND
119 Chromium	ND	ND
120 Copper	ND	ND
121 Cyanide	0.11	0.00053
122 Lead	ND	ND
124 Nickel	ND	ND
125 Selenium	ND	ND
126 Silver	NR	NR
128 Zinc	ND	ND

---

(1) For C&TT Code definitions, see Table VII-1.

ND : Not detectable.
NR : Not reported.
N/A: Not applicable.

TABLE VII-5

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
HYDRIDE

Raw Wastewater

	Reference Code	176-01		256-01					
	Plant Code	132		139					
	Sample Point	O		B		Average(1)		Overall Average(2)	
	Flow (GPT)	615		1.8		308.4			
		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	492	1.26	396	0.0029	444	0.63	421.3	1.047
	Dissolved Iron	0.45	0.001	36.5	0.00027	18.5	0.0006	12.45	0.001
	pH (Units)	12.4	N/A	11.4	N/A	11.4-12.4	N/A	11.4-12.4	N/A
114	Antimony	0.20	0.0005	0.75	0.000005	0.48	0.0003	0.48	0.0003
118	Cadmium	*	**	0.12	0.0000009	0.06	0.0000005	0.04	0.0000003
119	Chromium	15.3	0.039	1.5	0.00001	8.4	0.039	5.59	0.026
120	Copper	0.67	0.0017	0.52	0.000004	0.59	0.00085	0.40	0.00057
121	Cyanide	ND	ND	ND	ND	ND	ND	0.035	0.00018
122	Lead	0.25	0.0006	1.1	0.000008	0.675	0.0003	0.45	0.0002
124	Nickel	8.7	0.022	0.310	0.000002	4.505	0.011	3.003	0.0073
125	Selenium	NR	NR	0.035	0.0000002	0.035	0.0000002	0.018	0.0000001
126	Silver	0.02	0.00005	0.115	0.0000009	0.068	0.000025	0.068	0.000025
128	Zinc	0.075	0.00019	0.2	0.0000015	0.14	0.000096	0.092	0.000064

TABLE VII-5
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
HYDRIDE
PAGE 2

Effluent

	Reference Code	176-01		256-01	
	Plant Code	132		139	
	Sample Point	$\frac{O(106)}{Z(769)}$ ZZ(772)		$\left[\frac{B-1\ (0.04)}{B-1\ (0.04) + C-1\ (4.58) + D-1\ (0.104)}\right]$ E-1 (4.79)	
	Flow(2) (GPT)	615		1.8	
	C&TT(3)	CNT(17),CR,PSP,NA,CO CLA,EB,FLP,NC,NW,CL, SL,SSP,T,SS,CY		CLA,NA,SL,CNT(66)	
		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	16.5	0.0445	69	0.00017
	Dissolved Iron	0.83	0.000004	0.23	**
	pH (Units)	7.6	N/A	8.2	N/A
114	Antimony	NR	NR	0.25	0.0000055
118	Cadmium	*	**	0.01	**
119	Chromium	0.18	0.00013	47.8	0.00000092
120	Copper	0.05	0.000038	0.05	0.0000023
121	Cyanide	0.035	ND	0.37	**
122	Lead	0.05	0.000035	0.05	0.00000021
124	Nickel	1.35	0.0020	0.21	**
125	Selenium	*	**	*	**
126	Silver	0.02	0.000045	0.02	0.0000013
128	Zinc	0.04	0.0000017	0.025	**

---

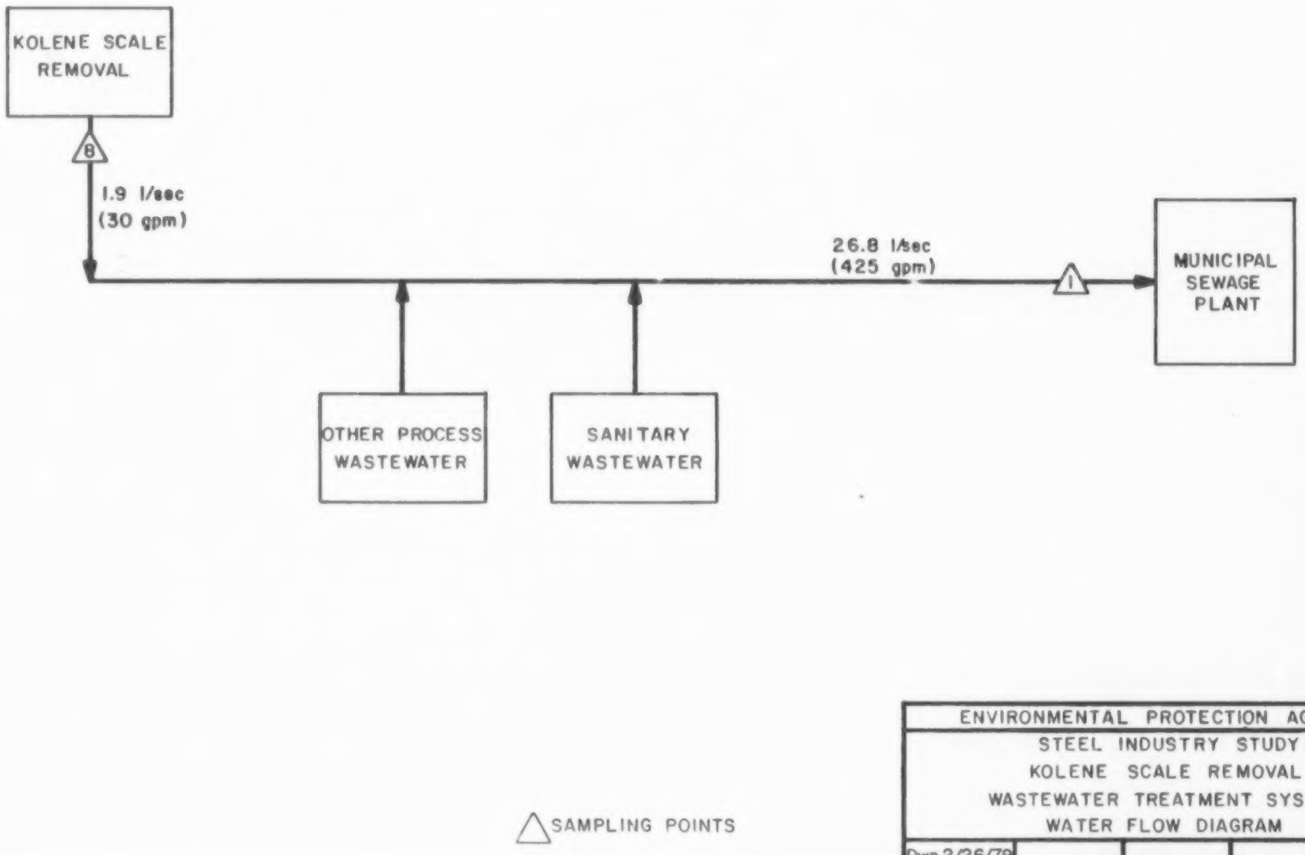
(1) Values listed as ND are included in average calculations as zero. Values listed as NR are not included.
(2) Average of values from Table VII-4 and VII-5.
(3) For C&TT Code definitions, see Table VII-1.

* : Less than 0.01 mg/l.
** : Less than 0.0000001 lbs/1000 lbs.
NR : Not reported.
ND : Not detected.
N/A: Not applicable.

PROCESS: KOLENE SCALE REMOVAL

PLANT: L

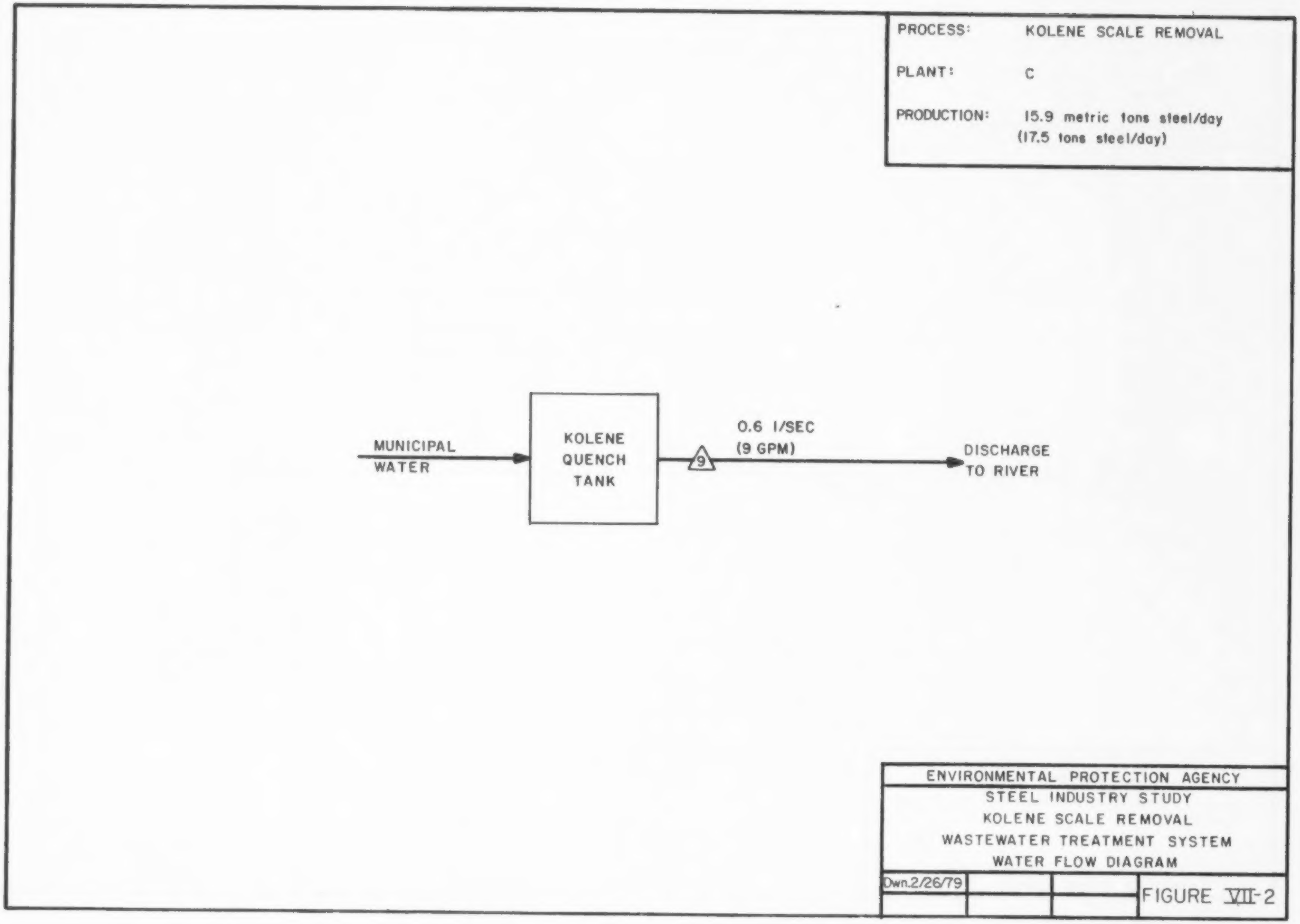
PRODUCTION: 32.8 metric tons steel/day
(36.2 tons steel/day)



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn.2/26/79

FIGURE VII-1



PROCESS: KOLENE SCALE REMOVAL

PLANT: C

PRODUCTION: 15.9 metric tons steel/day
(17.5 tons steel/day)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

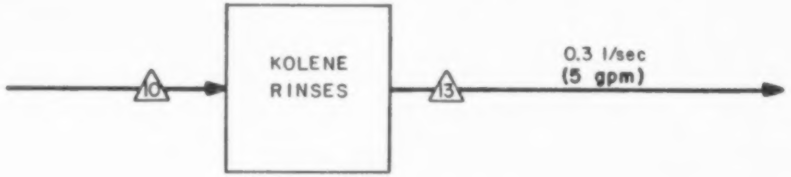
Dwn.2/26/79

FIGURE VII-2

PROCESS: KOLENE SCALE REMOVAL

PLANT: Q

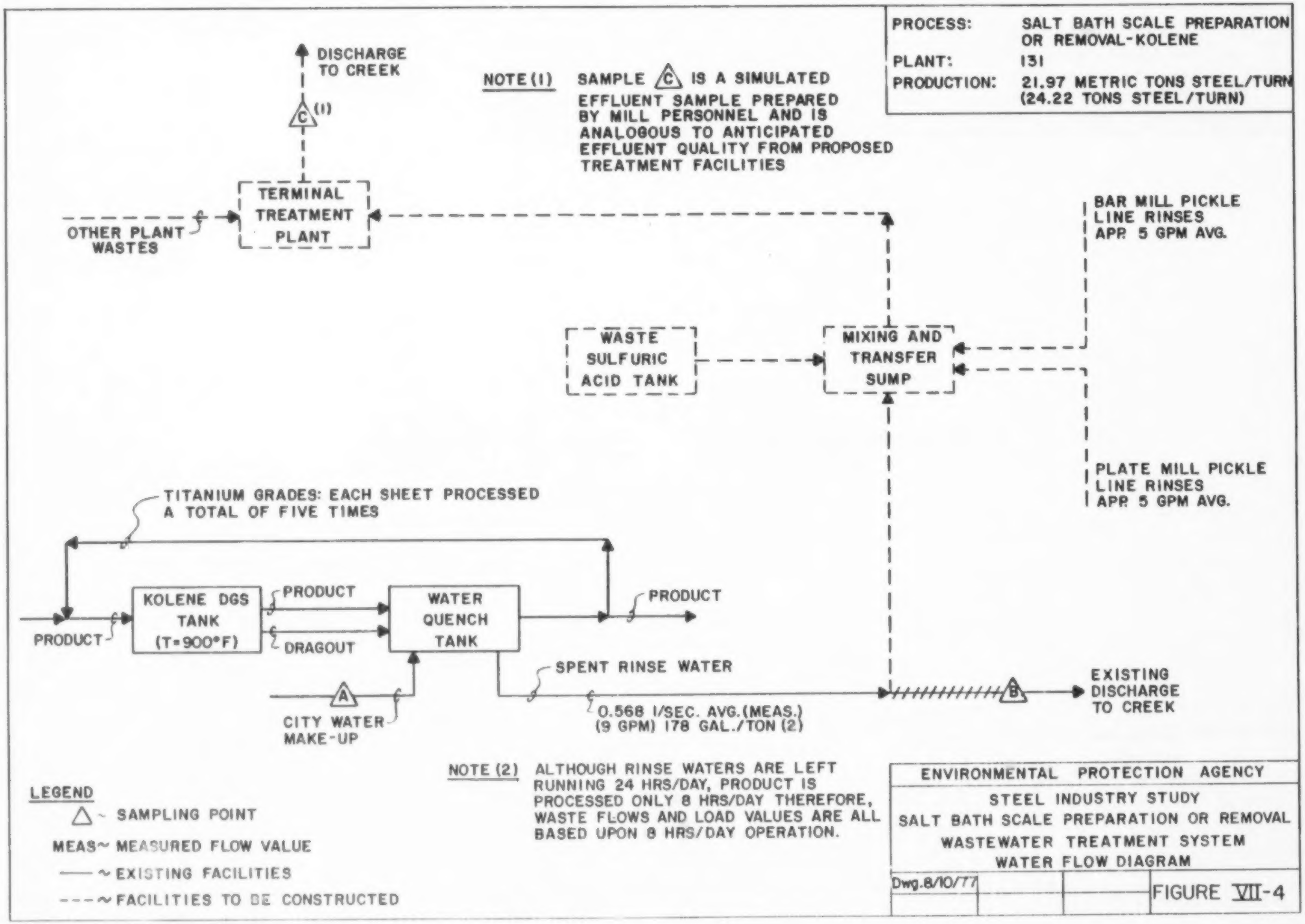
PRODUCTION: 60.3 metric tons steel/day
(66.5 tons steel/day)



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 2/26/79

FIGURE VII-3



DISCHARGE TO CREEK
C (1)
TERMINAL TREATMENT PLANT
OTHER PLANT WASTES
WASTE SULFURIC ACID TANK
MIXING AND TRANSFER SUMP
BAR MILL PICKLE LINE RINSES APP. 5 GPM AVG.
PLATE MILL PICKLE LINE RINSES APP. 5 GPM AVG.
TITANIUM GRADES: EACH SHEET PROCESSED A TOTAL OF FIVE TIMES
PRODUCT
KOLENE DGS TANK (T=900°F)
PRODUCT
DRAGOUT
WATER QUENCH TANK
PRODUCT
A
CITY WATER MAKE-UP
SPENT RINSE WATER
0.568 l/SEC. AVG.(MEAS.) (9 GPM) 178 GAL./TON (2)
B
EXISTING DISCHARGE TO CREEK

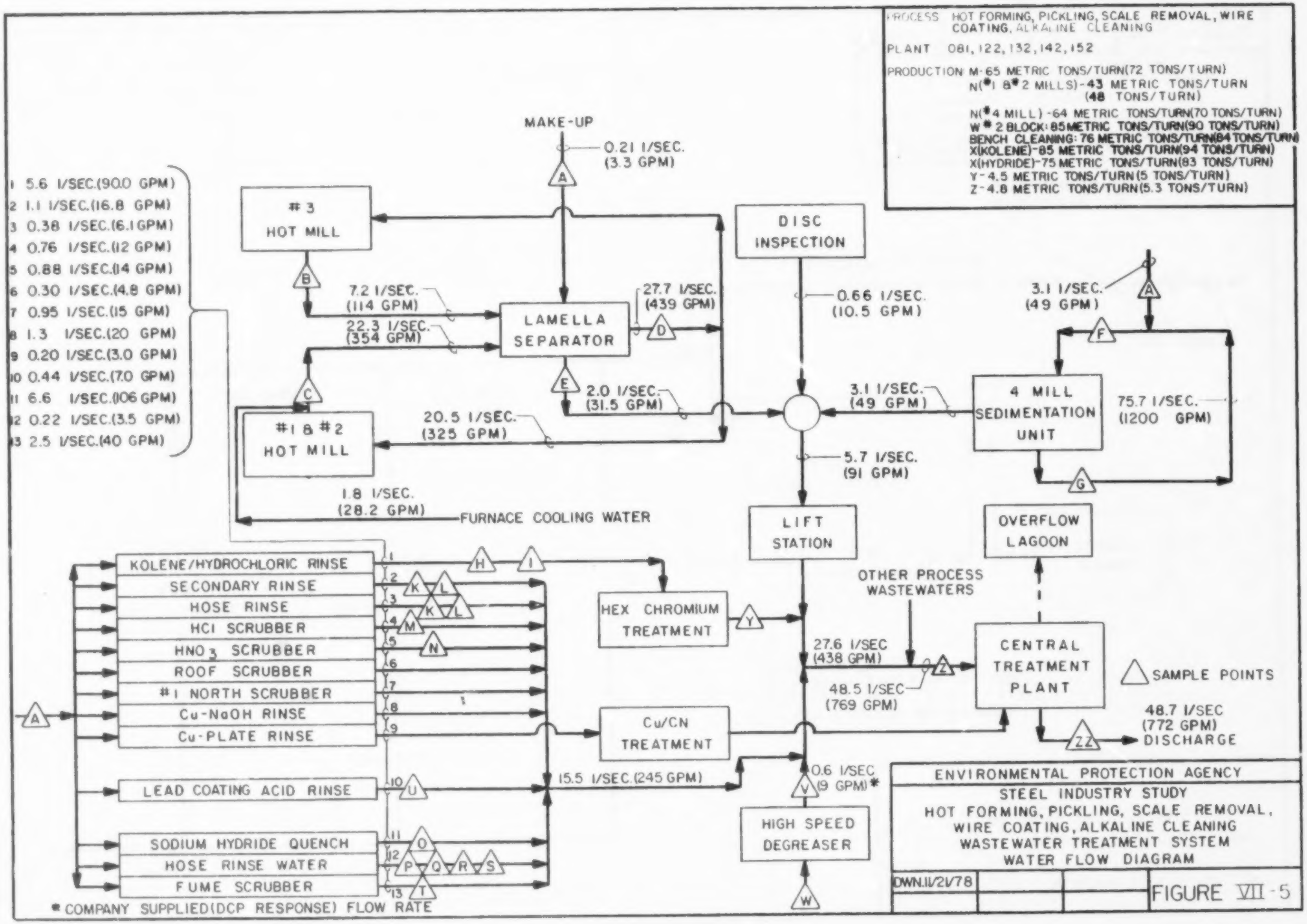
PROCESS: SALT BATH SCALE PREPARATION OR REMOVAL-KOLENE
PLANT: 131
PRODUCTION: 21.97 METRIC TONS STEEL/TURN (24.22 TONS STEEL/TURN)

NOTE (1) SAMPLE C IS A SIMULATED EFFLUENT SAMPLE PREPARED BY MILL PERSONNEL AND IS ANALOGOUS TO ANTICIPATED EFFLUENT QUALITY FROM PROPOSED TREATMENT FACILITIES

NOTE (2) ALTHOUGH RINSE WATERS ARE LEFT RUNNING 24 HRS/DAY, PRODUCT IS PROCESSED ONLY 8 HRS/DAY THEREFORE, WASTE FLOWS AND LOAD VALUES ARE ALL BASED UPON 8 HRS/DAY OPERATION.

LEGEND
△ ~ SAMPLING POINT
MEAS~ MEASURED FLOW VALUE
—— ~ EXISTING FACILITIES
- - - ~ FACILITIES TO BE CONSTRUCTED

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SALT BATH SCALE PREPARATION OR REMOVAL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM
Dwg. 8/10/77
FIGURE VII-4



PROCESS HOT FORMING, PICKLING, SCALE REMOVAL, WIRE COATING, ALKALINE CLEANING

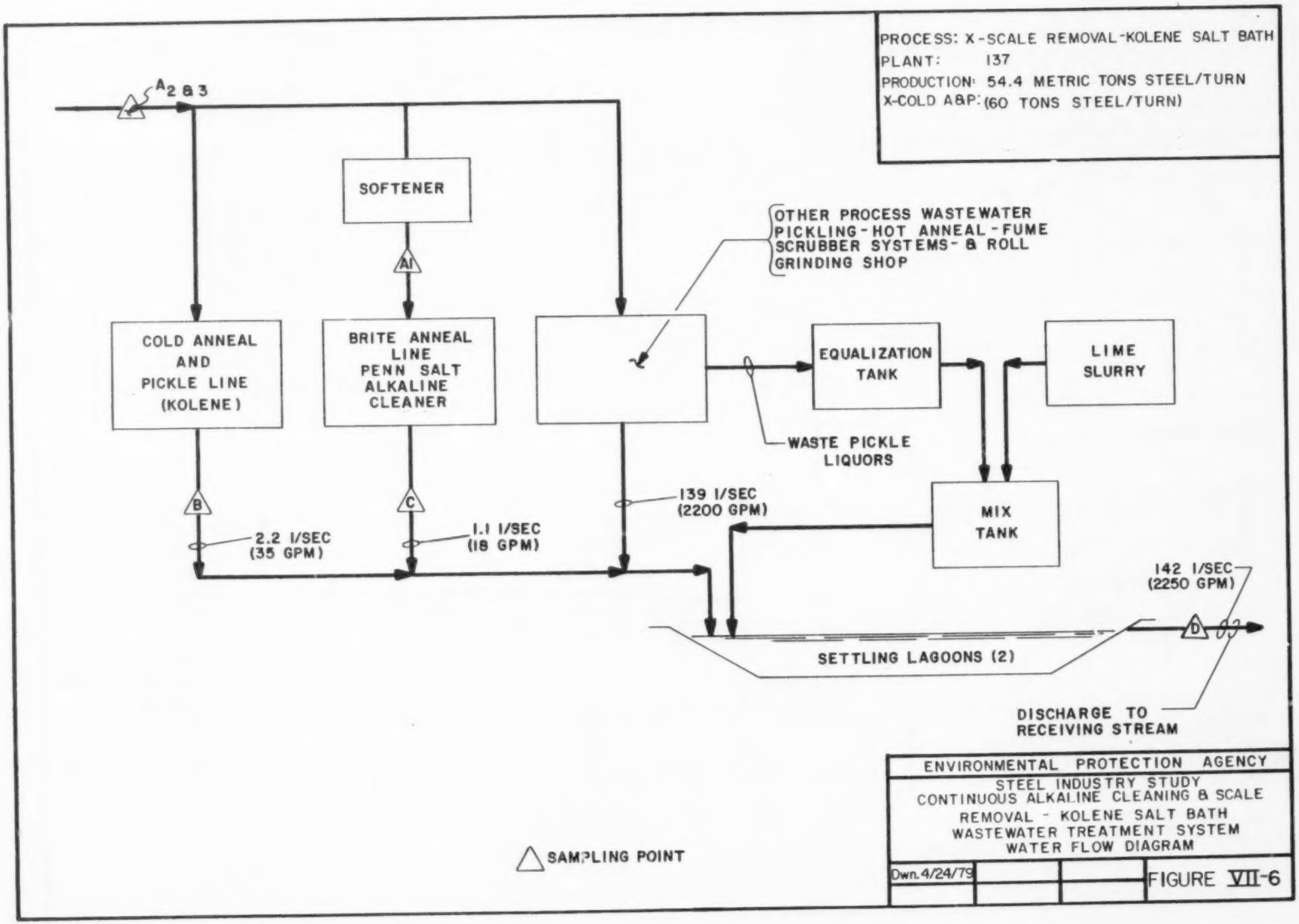
PLANT 081, 122, 132, 142, 152

PRODUCTION M-65 METRIC TONS/TURN(72 TONS/TURN)
N(#1 & #2 MILLS)-43 METRIC TONS/TURN (48 TONS/TURN)
N(#4 MILL)-64 METRIC TONS/TURN(70 TONS/TURN)
W #2 BLOCK: 85 METRIC TONS/TURN(90 TONS/TURN)
BENCH CLEANING: 76 METRIC TONS/TURN(84 TONS/TURN)
X(KOLENE)-85 METRIC TONS/TURN(94 TONS/TURN)
X(HYDRIDE)-75 METRIC TONS/TURN(83 TONS/TURN)
Y-4.5 METRIC TONS/TURN(5 TONS/TURN)
Z-4.8 METRIC TONS/TURN(5.3 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING, PICKLING, SCALE REMOVAL, WIRE COATING, ALKALINE CLEANING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWN.11/21/78

FIGURE VII-5



PROCESS: X-SCALE REMOVAL-KOLENE SALT BATH
PLANT: 137
PRODUCTION: 54.4 METRIC TONS STEEL/TURN
X-COLD A&P: (60 TONS STEEL/TURN)

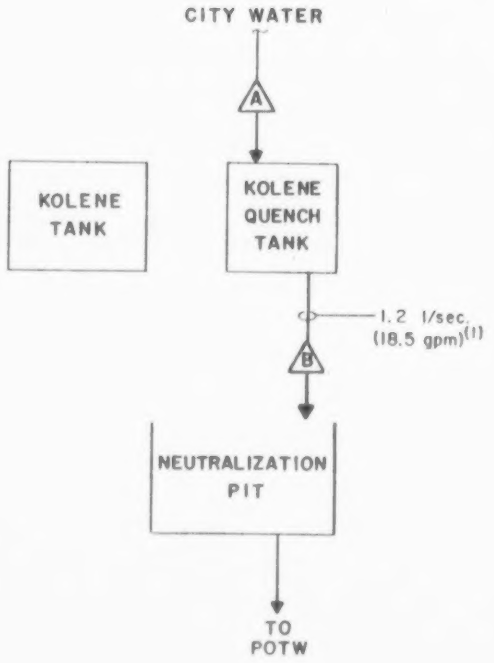
A2 & 3
SOFTENER
A1
COLD ANNEAL AND PICKLE LINE (KOLENE)
BRITE ANNEAL LINE PENN SALT ALKALINE CLEANER
OTHER PROCESS WASTEWATER PICKLING-HOT ANNEAL-FUME SCRUBBER SYSTEMS- & ROLL GRINDING SHOP
EQUALIZATION TANK
LIME SLURRY
WASTE PICKLE LIQUORS
MIX TANK
B
C
2.2 l/SEC (35 GPM)
1.1 l/SEC (18 GPM)
139 l/SEC (2200 GPM)
142 l/SEC (2250 GPM)
D
SETTLING LAGOONS (2)
DISCHARGE TO RECEIVING STREAM
SAMPLING POINT

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
CONTINUOUS ALKALINE CLEANING & SCALE REMOVAL - KOLENE SALT BATH WASTEWATER TREATMENT SYSTEM WATER FLOW DIAGRAM
Dwn. 4/24/79
FIGURE VII-6

PROCESS: KOLENE DESCALING

PLANT: 138

PRODUCTION: 23.6 METRIC TONS/TURN
(26 TONS/TURN)



NOTE
(1) Batch discharge occurs over 8 hours.

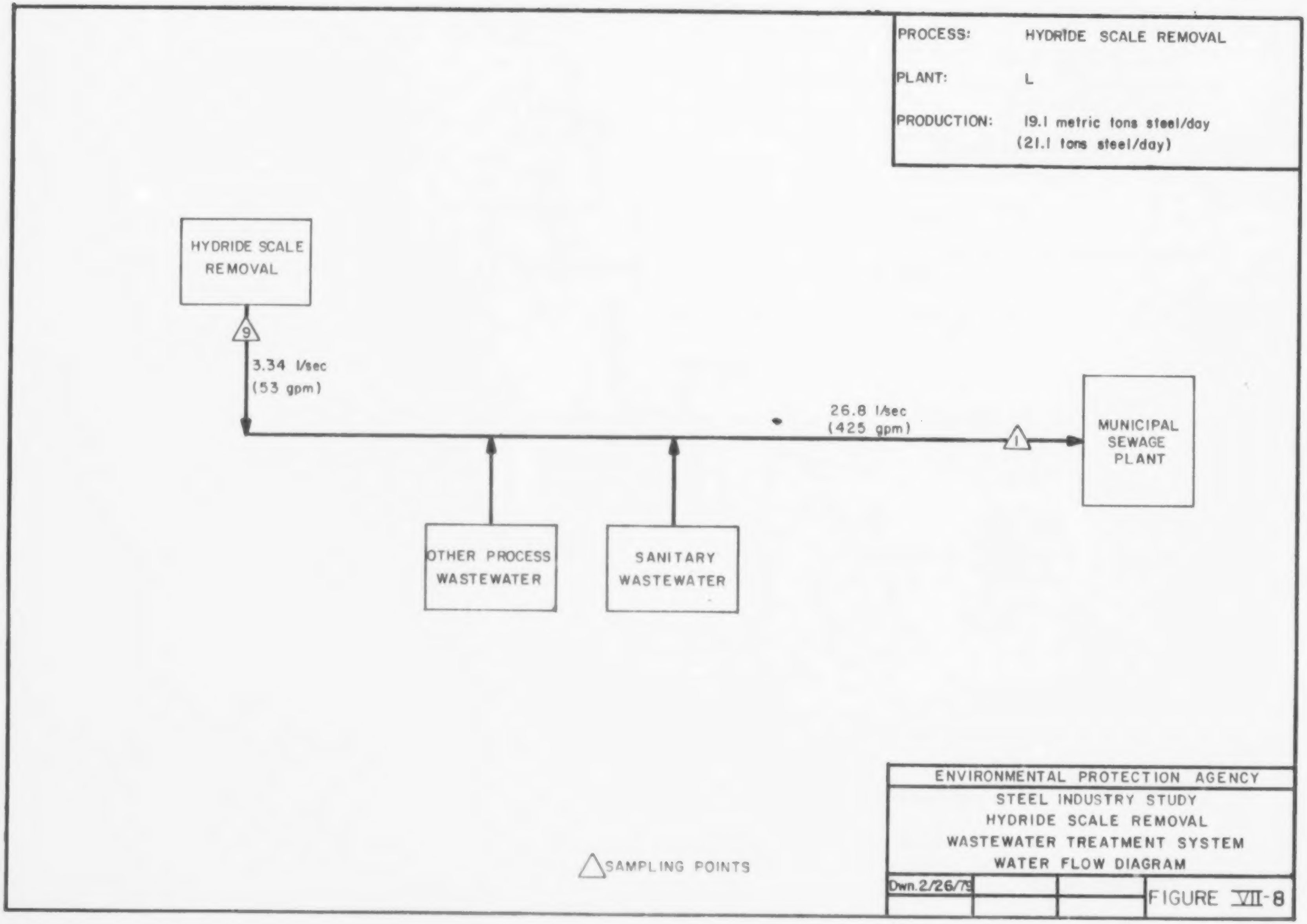
△ SAMPLING POINT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE DESCALING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWN. 8/1/78

FIGURE VII-7



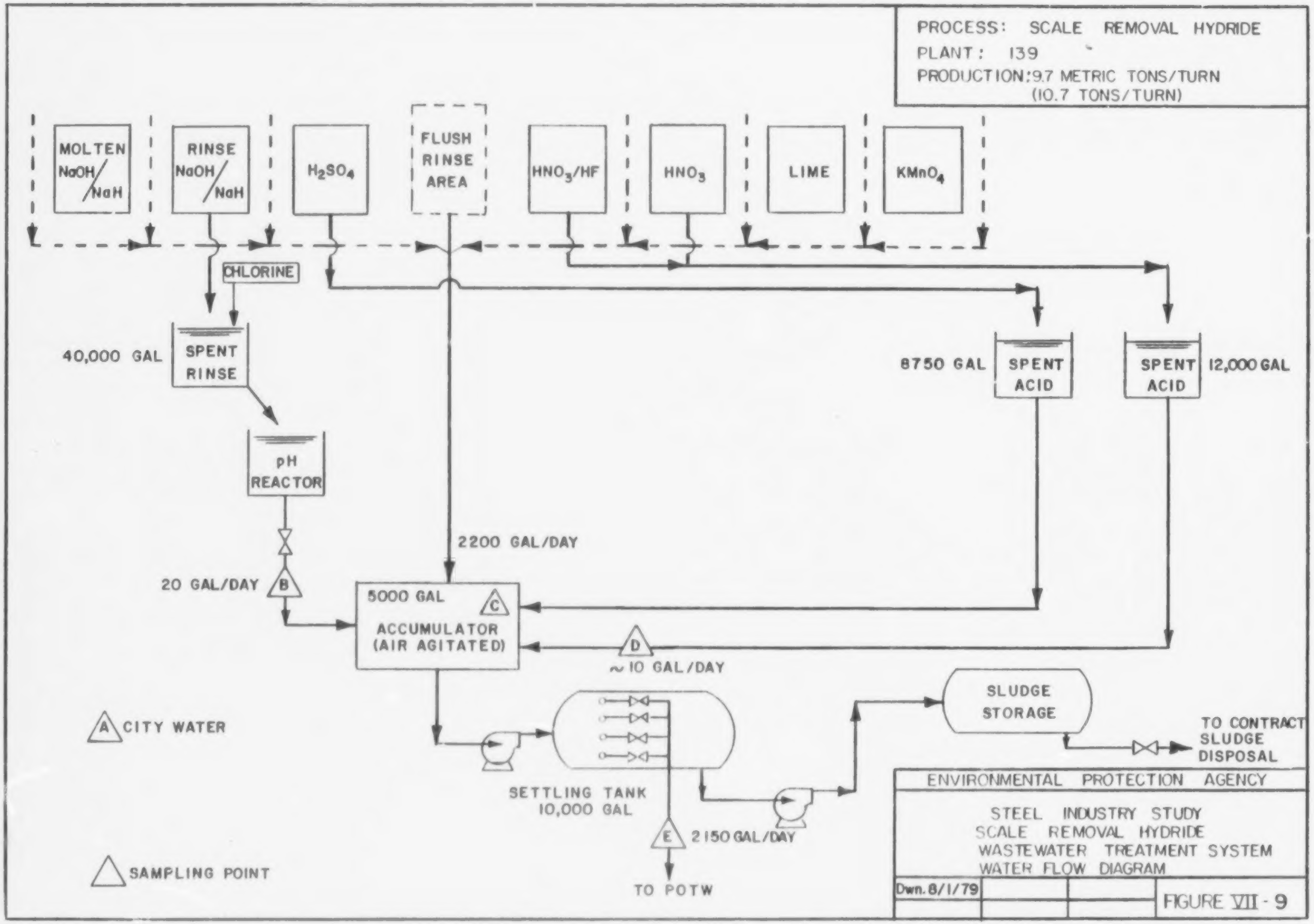
PROCESS: HYDRIDE SCALE REMOVAL

PLANT: L

PRODUCTION: 19.1 metric tons steel/day
(21.1 tons steel/day)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HYDRIDE SCALE REMOVAL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-8



PROCESS: SCALE REMOVAL HYDRIDE
PLANT: 139
PRODUCTION: 9.7 METRIC TONS/TURN
(10.7 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SCALE REMOVAL HYDRIDE
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 8/1/79

FIGURE VII - 9

SCALE REMOVAL SUBCATEGORY

SECTION VIII

COST, ENERGY, AND NON-WATER QUALITY IMPACTS

Introduction

This section presents the incremental costs incurred in applying the different levels of pollution control technology to scale removal operations. The analysis also describes energy requirements, nonwater quality impacts, and the techniques, magnitude, and costs associated with each alternative treatment system for each subdivision.

Actual Costs Incurred by the Operations Sampled for this Study

The water pollution control costs reported by the industry are presented in Tables VIII-1 and VIII-2. These costs were updated to July 1978 dollars from current year data. Standard costs of capital and depreciation percentages were used so that these basic costs would be comparable. Also, where central treatment systems are in use, the industry often supplied total cost data for the entire treatment system. These costs were apportioned as accurately as possible to isolate costs attributable to the treatment of scale removal wastewaters.

Because of the extensive use of central treatment for scale removal wastewaters, the Agency could not directly verify its model-based cost estimates for for separate treatment of scale removal wastes with cost data reported by the industry for central treatment systems. However, the Agency compared its model-based separate treatment costs with industry costs for several central treatment systems by summing the model-based separate treatment costs for each subcategory included in the existing central treatment systems. The results of this comparison presented in Volume I demonstrate that the Agency's costing methodology accurately reflects industry costs for central treatment facilities in general, and for those systems including scale removal wastewaters in particular. In fact, as shown by the data presented in Volume I, the Agency's cost estimates for separate treatment for finishing operation wastewaters are likely to be significantly higher than the costs which will actually be incurred by industry for central treatment.

Control and Treatment Technology (C&TT)

Effluent limitations and standards are being proposed for BPT, BAT, BCT, NSPS, PSES, and PSNS. The alternative treatment systems and components are presented in Tables VIII-3 and VIII-4. The technologies described therein represent treatment systems either in use or available for kolene and hydride scale operations. In addition to listing the treatment methods available, these tables also describe for each method:

1. Status and reliability
2. Problems and limitations
3. Implementation time
4. Land requirements
5. Environmental impacts other than water
6. Solid water generation

Cost, Energy, and Nonwater Quality Impacts

General Introduction

The installation of BPT, BCT, BAT, NSPS, PSES, and PSNS alternative treatment systems will require additional funding (both investment and operating) and energy requirements. Also, air pollution, water consumption and solid waste disposal impacts associated with each level of treatment are addressed in this section. Costs and energy requirements were estimated on the basis of the alternative treatment systems developed in Sections IX through XIII and are presented in the tables and text of this section.

Estimated Costs for the Installation of Pollution Control Technologies

A. Costs Required to Achieve the Proposed BPT Limitations

The BPT model costs are presented in Tables VIII-5 and VIII-6. However, not all plants will incur all these costs, as many are already operating at or near the BPT level of treatment. To obtain a more accurate accounting of costs required to comply with the proposed BPT limitations, a capital cost tabulation was performed for all scale removal lines. The tabulation presented in Tables VIII-7 and VIII-8 involve the application of the model costs to each line in both process subdivisions. These tabulations summarize the treatment installed at each line and present the required costs to attain the proposed BPT limitations.

The Agency estimated capital costs of the proposed BPT for kolene scale removal are 6.59 million dollars. Of this total, 3.18 million dollars is currently in place. The remaining 3.41 million dollars remains to be installed. The estimated annual costs for kolene scale removal are 1.83 million dollars. The estimated capital costs of BPT for the hydride type scale removal are 0.89 million dollars. Presently, 0.63 million dollars worth of treatment technology is in place. The remaining 0.26 million dollars is still required to be installed. The estimated annual costs for hydride scale removal are 0.32 million dollars.

To develop the above costs, model treatment systems were developed which are based upon average plant size and the model flow rates. Plant by plant capital cost estimates were then made by factoring the production of each plant to the model plant size by the "six-tenth" rule. This method yields cost estimates for the subcategory which are representative of the actual costs spent in the industry. Cost comparisons presented in Volume I verified the accuracy of this costing methodology. Because the DCP responses listed the treatment components already installed, costs for "in-place" components were separated from the total estimated cost.

As a final note, it should be pointed out that cost estimates were developed assuming all plants would install separate treatment systems. However, as pointed out earlier, wastewaters from most operations are treated in central treatment systems. Treatment in central systems reduces costs because of economies of scale and because duplicate equipment components are not needed. Hence, actual cost requirements for scale removal operations are expected to be less than the estimates presented above.

B. Costs Required to Achieve the Proposed BAT Limitations

The Agency considered three BAT alternative treatment systems. The descriptions of rationale for considering, and additional details regarding the alternatives are provided in Section X. The additional investment and annual expenditures involved in applying each of the BAT alternative treatment systems are presented in Tables VIII-9 and VIII-10. The estimated investment and annual cost for each model BAT treatment system follow:

Kolene Scale Removal

BAT Alternative	Investment Costs In-Place	Investment Costs Required	Annual Cost
No.1	$140,000	$ 2,520,000	$ 477,000
No.2	$140,000	$ 3,280,000	$ 621,000
No.3	0	$38,680,000	$8,780,000

Hydride Scale Removal

BAT Alternative	Investment Costs In-Place	Investment Costs Required	Annual Cost
No.1	$ 0	$ 564,000	$ 101,000
No.2	$ 0	$ 744,000	$ 135,000
No.3	$ 0	$5,610,000	$1,020,000

C. Cost Required to Achieve Proposed BCT Limitations

The BCT cost analysis is presented in Table VIII-11, and information regarding BCT is provided in Section XI.

The BCT model treatment system considered for kolene operations fails the cost-reasonableness test. Therefore, the proposed BCT limitations are the same as the proposed BPT limitations for conventional pollutants.

The BCT model treatment system considered for hydride operations passes the cost-reasonableness test. The total costs required to achieve the proposed BCT limitations are included in the costs required for BAT Alternative No. 1.

D. Costs Required to Achieve the Proposed NSPS

The Agency considered two alternative treatment systems for scale removal facilities which are constructed after the proposal of New Source Performance Standards. The NSPS alternative treatment systems are similar to the BPT/BAT treatment systems. The NSPS alternative treatment systems are discussed in Section XII and treatment model costs for those alternatives are presented in Tables VIII-12 and VIII- 13.

E. Costs Required to Achieve the Proposed Pretreatment Standards

Pretreatment standards apply to those existing and new sources which continue or elect to discharge to POTW systems. Refer to Section XIII for additional information pertaining to pretreatment standards. The costs for the pretreatment models are presented in Tables VIII-12 through VIII-15.

Energy Impacts

Moderate amounts of energy are required by the various levels of treatment in the scale removal subcategory. The major energy expenditures for the subcategory occur at the BPT treatment level. It should be noted that while BAT Alternatives No. 1 and No. 2 require relatively minor additional energy, BAT Alternative No. 3 requires a significant amount of electrical energy. The Agency considered this factor in selecting the BAT model treatment system (see Section X).

A. Energy Impacts at BPT

The estimated energy requirements are based upon the assumption that all scale removal operations install treatment systems similar to that of the treatment model, with flows similar to those of the model. On this basis, the annual energy usage for the BPT model treatment system for all kolene scale removal operations is 1.29 million kilowatt-hours of electricity. The energy usage for BPT treatment components for all hydride scale removal operations is 0.26 million kilowatt-hours of electricity. The total energy needs to comply with the proposed BPT limtations totals 1.55 million kilowatt-hours. This represents less than 0.01% of the 57 billion kilowatt-hours of electricity used by the steel industry in 1978.

B. Energy Impacts at BAT

The estimated energy requirements at the BAT level of treatment are based upon the same assumptions noted above for BPT. Following are the estimated energy requirements needed to upgrade the BPT model treatment system to the three BAT alternative treatment systems, and their relationship to the 1978 industry power usage:

BAT Alternative	kwh/year	% of Industry Usage
Kolene		
No.1	152,000	0.00027
No.2	228,000	0.00040
No.3	17,556,000	0.031
Hydride		
No.1	48,000	0.000084
No.2	72,000	0.00013
No.3	672,000	0.0012

The Agency does not consider these requirements to be significant in light of the comparison to total industry usage and are justified by the associated effluent reduction benefits.

C. Energy Impacts at BCT

No additional energy is required to upgrade the BPT model treatment system to the BCT level of treatment for kolene operations as the BPT and BCT limitations are identical.

The estimated energy required to upgrade BPT to the BCT level of treatment for hydride operations is included in the energy required to upgrade BPT to the BAT level of treatment.

D. Energy Impacts at NSPS, PSES, and PSNS

Following are the energy requirements for the NSPS, PSES, and PSNS treatment models.

Treatment Model	kwh/year
Kolene	
NSPS No.1	40,000
NSPS No.2	40,000
PSES No.1	68,000
PSES No.2	68,000
PSNS No.1	40,000
PSNS No.2	40,000
Hydride	
NSPS No.1	32,000
NSPS No.2	40,000
PSES No.1	32,000
PSES No.2	44,000
PSNS No.1	32,000
PSNS No.2	40,000

The energy consumption for PSES are included in that for the BPT and BAT, while only model-based energy consumption is presented for NSPS and PSNS, respectively.

Nonwater Quality Impacts

In general, the nonwater quality impacts associated with the proposed treatment technologies are minimal. The three impacts evaluated were air pollution, solid waste disposal, and water consumption.

A. Air Pollution

Sulfur dioxide is used to reduce hexavalent chromium in the BPT and NSPS treatment systems. Excess levels may be discharged to the atmosphere during treatment. Sulfide addition is incorporated in the BAT Alternative No. 2 treatment systems. In the event of treatment process control upsets, the atmospheric discharge of sulfides could occur. Neither the possible sulfur dioxide nor the possible sulfide air emissions are considered significant since only minor emissions are expected.

B. Solid Waste Disposal

The treatment steps incorporated in the BPT and BAT treatment systems will remove a significant quantity of the solids contained in scale removal wastewaters. Following is a summary of the solid waste generation for all scale removal operations at the BPT, BAT, and BCT levels of treatment.

Treatment Level	Solid Waste Generation Scale Removal Subcategory (Tons/Year)
Kolene	
BPT	1336
BAT No.1	8.6
BAT No.2	8.6
BAT No.3	21.0
Hydride	
BPT	64.7
BAT No.1-BCT	1.4
BAT No.2	1.4
BAT No.3	3.4

As shown above, most suspended solids are generated by the BPT model treatment system, while the BAT alternative treatment systems generate relatively minor additional amounts of solid wastes. Most of the solid wastes require proper disposal. As the vast majority of these wastes are generated at the BPT level of treatment and are being disposed of at the present time, the Agency believes that the solid waste impacts associated with this proposed regulation are reasonable and justified. A more detailed discusssion of this issue is contained in Volume I.

Following are the estimated amounts of solid wastes generated by NSPS and Pretreatment models.

Treatment Level	Solid Waste Generation Scale Removal Subcategory (Tons/Year)
Kolene	
NSPS No.1	54.6
NSPS No.2	54.6
PSES No.1	70.8
PSES No.2	70.8
PSNS No.1	54.6
PSNS No.2	54.6
Hydride	
NSPS No.1	11.2
NSPS No.2	11.2
PSES No.1	11.0
PSES No.2	11.0
PSNS No.1	11.2
PSNS No.2	11.2

The solid wastes generated at the NSPS and Pretreatment levels are of the same nature as those generated at BPT and BAT levels of treatment and present the same disposal requirements as those presented for BPT and BAT.

C. Water Consumption

Water will not be consumed at scale removal operations as a result of compliance with the proposed BPT, BAT, NSPS, PSES, and PSNS limitations and standards.

Summary of Nonwater Quality Impacts

The Agency concludes that the effluent reduction benefits described below for the scale removal subcategory justify any adverse impacts associated with energy consumption, air pollution, solid waste disposal, or water consumption:

	Effluent Discharge (tons/yr)		
Kolene	Raw Waste	Proposed BPT	Proposed BAT
Flow, MGD	1.24	1.24	0.79
TSS	1544.43	32.18	12.34
Toxic Organics	0.039	0.039	0.025
Toxic Metals	584.70	2.57	0.57
Other Pollutants	514.8	0.064	0.041
Hydride			
Flow, MGD	1.44	1.44	0.12
TSS	810.36	40.52	2.02
Toxic Organics	1.62	0.41	0.034
Toxic Metals	21.02	5.16	0.14
Other Pollutants	64.83	1.62	0.027

TABLE VIII-1

REPORTED EFFLUENT TREATMENT COSTS
KOLENE SCALE REMOVAL OPERATIONS

Reference No.	424-01*	176-04*	440A-01	776-M	684D	432
Plant Code	C & 131	132	L & 138	N/A	Q*	137*
C&TT(1)	VF,CR,FLP,NL,NW, NA,CL,SL,T	CR,PSP,NA,CO,CLA, EB,FLP,NC,NW,CL,SL, SSP,T,SS,CY	NW,SL	NW,CT,T	None	NW,NL,SL
Plant Type	Batch	Batch	Batch	Batch	Continuous	Continuous
Initial Investment	1,290,000	244,145	None	175,221	None	14,551
Annual Costs						
Cost of Capital	55,470	10,498	-	7,534	-	626
Depreciation	129,000	24,415	-	17,522	-	1,455
Operation & Maintenance	101,780	12,446	-	10,648	-	991
Energy & Power	18,453	16,154	-	2,124	-	-
Miscellaneous	-	-	227	-	-	-
TOTAL	304,703	63,513	227	37,828	None	3,072
$/Ton	41.9	1.37	0.010	29.10	-	0.045
$/1000 Gal. Trt.	235.4	3.90	0.029	2.07	-	0.016

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(1) For C&TT Code definitions, see Table VII-1.

* : Costs attributed to this subcategory.
NA: Not applicable.

TABLE VIII-2

REPORTED EFFLUENT TREATMENT COSTS HYDRIDE SCALE REMOVAL OPERATIONS

Reference No.	440A	456N-01	176-01
Plant Code	L*	139*	132*
C&TT Code(1)	NW,SL	CLA,NA,SL	CR,PSP,NA,CO,CLA, EB,FLP,NC,NW, CL,SL,SSP,T,SS,CY
Initial Investment	None	8,000	20,067
Annual Costs			
Costs of Capital	-	344	863
Depreciation	-	800	2,007
Operation & Maintenance	-	9,730	2,550
Energy & Power	-	38.6	2,368
Miscellaneous	464	-	-
TOTAL	464	10,913	7,788
$/Ton	0.028	1.09	0.340
$/1000 Gal. Trt.	0.0232	605.6	5.90

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(1) For C&TT Code definitions, see Table VII-1.

*: Costs attributable to this subcategory.

TABLE VIII-3

CONTROL AND TREATMENT TECHNOLOGIES
SCALE REMOVAL SUBCATEGORY - KOLENE

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Acid Addition - Operation wastewater is treated by additions of acid in the mixing tank to lower pH to the 2-4 range.	Practiced at the majority of mills in this subcategory.	Increase cost unless source of acid exists at plant.	6 months	25' x 25'	None	None
B. Sulfur Dioxide Addition - Hexavalent chromium is reduced to the trivalent state by the addition of a reducing agent such as sulfur dioxide. This step is used in conjunction with Step A.	Practiced at the majority of mills in this subcategory.	Increased cost associated with chemical addition.	Included in Step A.	No additional land required. Included in Step A.	None	None
C. Oil Skimming - Effluent from Step B is treated with skimmer in pit to reduce oil levels.	Practiced at a few mills in this subcategory.	Removes primary floating oils.	3 months	50' x 50'	None	Oil sludge must be incinerated or disposed of in land fill.
D. Lime Neutralization - Lime is added to Step C in order to raise the pH in the mixing tank to the 6-9 range where optimum metal removel will occur in subsequent steps.	Widely practiced by mills in this subcategory.	Increased chemical costs and significant solids loads generated.	6 months	50' x 50'	None	Produces tons of sludge per day. Sludge must be disposed of in landfill.
E. Polymer Addition - Polymer is added to the same mixing tank used in Step D to aid precipitation.	Widely practiced in this subcategory. It is a reliable method of promoting settling characteristics.	Increased chemical costs.	Included in D.	No additional space necessary.	None	No significant amount of sludge generated.
F. Clarification - The neutralized wastes, from Step E, enter a flocculation - clarifier where sedimentation occurs.	Widely practiced in industry and at the majority of mills in this subcategory.	Needs considerable maintenance.	15-18 months	25' x 25'	Produces some additional sludges.	Sludges that may contain metals are generated and must be disposed of in a landfill.

TABLE VIII-3
CONTROL AND TREATMENT TECHNOLOGIES
SCALE REMOVAL SUBCATEGORY - KOLENE
PAGE 2

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
G. Vacuum Filtration - Used to dewater the clarifier underflows (last step in BPT).	Widely practiced in the industry and by the majority of mills in this subcategory.	Increase capital and operating costs.	15-18 months	30' x 30'	Sludges require disposal.	Produces approximately 100 lbs./day of sludge that must be disposed of in landfill.
H. Filtration - The effluent from Step F is treated with a mixed-media filtration system to promote suspended solids removal (BAT Alternative 1).	Widely practiced in the steel industry and at several mills in this subcategory.	Increased capital and operating costs.	15-18 months	25' x 25'	See solid waste discussion.	Some additional sludge may be generated when the filters are backwashed. The sludge will contain mainly oils and solids, but may contain some metallic compounds.
I. Sulfide Addition - Prior to Step H, install a sulfide addition system to aid in the precipitation of solids and metals (BAT Alternative 2).	This system, in conjunction, with the filtration unit, has shown to be an effective means to reduce the levels of heavy metals in wastewater streams.	Additional operating costs and increased sludge production. Care must also be taken to guard against H_2S gas formation.	6 months	25' x 25'	See Solid Waste Impacts.	There is the potential for up to 2,000 additional lbs. of wet sludge to be generated per day due to the sulfide addition.
J. Evaporation - A vapor decompression evaporation system is installed in order to concentrate dissolved solids (BAT Alternative 3, Step 1 of 2).	Demonstrated in the power generation industry.	Needs considerable maintenance. Economics dependent on the integration of this system into the water cycle.	18 months	60' x 60'	Uses approximately 90 kwh/1000 gallons of feed water.	Slurry generated in this process must be dewatered. Sludge generation is increased and sludges may contain some metallic compounds.

TABLE VIII-3
CONTROL AND TREATMENT TECHNOLOGIES
SCALE REMOVAL SUBCATEGORY - KOLENE
PAGE 3

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
K. Recycle - The distillate quality effluent from Step E is recycled back to the kolene process (BAT Alternative 3, Step 2 of 2).	This step results in a zero discharge of process water. Widely practiced in the steel industry.	None	12-14 months	25' x 25'	None	None

TABLE VIII-4

CONTROL AND TREATMENT TECHNOLOGIES
SCALE REMOVAL SUBCATEGORY - HYDRIDE

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Chlorine Addition - Chlorine or other oxidizing agents are added to the hydride wastewater to chemically oxidize the cyanides.	Practiced at the majority of mills in this subcategory.	Increased chemical costs.	6 months	25' x 25'	None	None
B. Acid Neutralization - Acid is added to Step A in order to get the pH within the 6-9 range where optimum metal removal will occur in subsequent steps.	Practiced at the majority of mills in this subcategory.	Increased chemical costs.	6 months	50' x 50'	None	None
C. Polymer Addition - Polymer is added to Step B to aid in settling.	Widely practiced in this subcategory.	Increased chemical costs.	Inclued in B.	No additional space required.	None	No significant amounts of sludge generated.
D. Clarification - The wastes from Step C enter a flocculation clarifier where sedimentation occurs.	Widely practiced in industry and at the majority of mills in this subcategory.	Increased chemical costs.	15-18 months	25' x 25'	None	None
E. Vacuum Filtration - Used to dewater the clarifier underflows (last step in BPT).	Practiced at some mills in this subcategory.	Needs maintenance.	15-18 months	20' x 20'	Sludges require disposal.	Produces approximately 100 lbs/day of sludge that must be disposed of in landfill.
F. Filtration - The effluent from Step D is treated with a mixed-media filtration system to promote suspended solids removal (BAT Alternative 1).	Widely practiced in the steel industry and at several mills in this subcategory.	Increased capital and operating costs.	15-18 months	25' x 25'	See Solid Waste discussion.	Some additional sludge may be generated when the filters are backwashed. The sludge will contain mainly oils and solids but may contain some metallic compounds.

TABLE VIII-4
CONTROL AND TREATMENT TECHNOLOGIES
SCALE REMOVAL SUBCATEGORY - HYDRIDE
PAGE 2

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
G. Sulfide Addition - A sulfide addition system is installed prior to Step F to aid in the precipitation of solids and metals (BAT Alternative 2).	This system, in conjunction with the filtration unit, has shown to be an effective means of reducing the levels of heavy metals in wastewater streams.	Addtional operating costs and increased sludge production. Care must also be taken to guard against H_2S gas formation.	6 months	No additional space required.	See Solid Waste Impacts	Some additional sludge will be generated as a result of the installation of this system, however, because of the low flow from this process the additional production should be less than 1000 lbs/day of wet sludge.
H. Evaporation - A vapor decompression evaporation system is installed to concentrate dissolved solids (BAT Alternative 3, Step 1 of 2).	Demonstrated in the power generation industry.	Needs considerable maintenance. Economics dependent on the integration of this system into the water cycle.	18 months	60' x 60'	Uses approximately 90 kwh/1000 gallons of feed water.	Slurry generated in this process must be dewatered. Sludge generation is increased and sludges may contain some metallic compounds.
I. Recycle - The distillate quality effluent from Step I is recycled back to the hydride process.	This step results in a zero discharge of process water. Widely practiced in the steel industry.	None	15-18 months	25' x 25'	None	None

TABLE VIII-5

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Scale Removal
: Kolene
: Specialty

Model Size-TPD : 130
Oper. Days/Year: 250
Turns/Day : 2

C&TT Step	A	B	C	D	E	F(2)	G(2)	Total
Investment $\$ \times 10^{-3}$	57	51	39	61	55	114	128	505
Annual Cost $\$ \times 10^{-3}$								
Capital	2.4	2.2	1.7	2.6	2.4	4.9	5.5	21.7
Depreciation	5.7	5.1	3.9	6.1	5.5	11.4	12.8	50.5
Operation & Maintenance	2.0	1.8	1.4	2.6	1.9	4.0	4.5	18.2
Sludge Disposal	-	-	-	-	-	-	1.5	1.5
Energy & Power(1)	0.1	0.1	0.1	0.2	0.2	0.3	1.2	2.2
Chemical Costs	0.3	6.3	-	0.1	0.5	-	-	7.2
TOTAL	10.5	15.5	7.1	11.6	10.5	20.6	25.5	101.3

	Effluent Quality(3)	Raw Waste Level	Treated Effluent Level
	Flow, gal/ton	500	500
	Total Susp. Solids	1200	25
	Hexavalent Chromium	400	0.050
	pH	8-12	6-9
23	Chloroform	0.030	0.030
114	Antimony	0.10	0.10
115	Arsenic	0.025	0.025
118	Cadmium	0.010	0.010
119	Chromium	450	0.50
120	Copper	2.0	0.50
124	Nickel	2.0	0.50
125	Selenium	0.060	0.060
127	Thallium	0.20	0.20
128	Zinc	0.10	0.10

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(1) Costs are all power unless noted otherwise.
(2) Treatment components are used in tandem.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Acid Addition
B: Chemical Reduction
C: Oil Skimming
D: Neutralization with Lime
E: Polymer Addition
F: Clarifier
G: Vacuum Filter

TABLE VIII-6

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Scale Removal
: Hydride
: Specialty

Model Size-TPD : 200
Oper. Days/Year: 270
Turns/Day : 3

C&TT Step	A	B	C	D(2)	E(2)	Total
Investment \$ x 10^{-3}	109	74	85	188	126	582
Annual Cost \$ x 10^{-3}						
Capital	4.7	3.2	3.7	8.1	5.4	25.1
Depreciation	10.9	7.4	8.5	18.8	12.6	58.2
Operation & Maintenance	3.8	2.6	3.0	6.6	4.4	20.4
Sludge Disposal	-	-	-	-	3.1	3.1
Energy & Power(1)	6.2	0.3	0.3	0.6	.23	3.6
Chemical Costs	2.0	1.9	1.4	-	-	5.3
TOTAL	21.6	15.3	16.9	34.1	27.8	115.7

	Effluent Quality(3)	Raw Waste Level	Treated Effluent Level
	Flow, gal/ton	1200	1200
	Suspended Solids	500	25
	Dissolved Iron	40	1.0
	pH, Units	8-12	6-9
114	Antimony	0.80	0.50
118	Cadmium	0.10	0.10
119	Chromium	5.00	0.50
120	Copper	0.75	0.50
121	Cyanide	1.0	0.25
122	Lead	1.00	0.50
124	Nickel	5.00	0.50
125	Selenium	0.025	0.025
126	Silver	0.10	0.10
128	Zinc	0.20	0.20

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(1) Costs are all power unless noted otherwise.
(2) Treatment components are used in tandem.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Alkaline Chlorination
B: Polymer Addition
C: Neutralization with Acid
D: Thickener
E: Vacuum Filter

TABLE VIII-7

BPT CAPITAL COST TABULATION

BASIS: 7/1/78 DOLLARS X 10^{-3}
: FACILITIES IN PLACE AS OF 1/1/78

Subcategory: Scale Removal
: Kolene
: Specialty

Plant Code	TPD	C&TT Step A	B	C	D	E	F	G	In Place	Required	Total
0020B	309	103	94	72	114	103	188	177	676	175	851
0060D	300	101	92	71	112	101	185	173	571	264	835
0060I	190	77	70	54	85	77	141	132	232	404	636
0088A	105	54	49	38	60	54	99	92	392	54	446
0176	203	80	73	56	89	80	146	137	661	0	661
0248A	138	63	58	45	70	63	116	109	237	287	524
0248D	1	33	3.0	2.3	3.7	3.3	6.0	5.7	9.3	18.0	27.3
0432L	34	27	25	19	30	27	50	47	0	225	225
0440A	63	39	36	28	44	39	73	68	73	254	327
0528	507	138	127	97	154	138	253	238	251	894	1145
0684D	69	42	38	29	46	42	77	72	0	346	346
0776G	45	8.1	7.4	5.7	9.0	8.1	14.9	13.9	32.0	35.1	67.1
0776H	13	15	14	11	17	15	28	26	42	84	126
0856E	78	45	41	32	50	45	82	77	0	372	372
									3176.3*	3412.1*	6588.4*

---

* Totals do not include confidential plants or dry operations.
Note: Underlined costs represent facilities in place.

KEY TO C&TT STEPS

A: Neutralization with Acid
B: Chemical Reduction
C: Oil Skimming
D: Neutralization with Lime
E: Polymer Addition
F: Clarifer
G: Vacuum Filter

TABLE VIII-8

BPT CAPITAL COST TABULATION

BASIS: 7/1/78 DOLLARS X 10^{-3}
: FACILITIES IN PLACE AS OF 1/1/78

Subcategory: Scale Removal
: Hydride
: Specialty

Plant Code	TPD	C&TT Step A	C&TT Step B	C&TT Step C	C&TT Step D	C&TT Step E	In Place	Required	Total
0176	453	91	78	82	96	126	473	0	473
0248B	NA	-	-	-	-	-	-	-	-
0256K	165	50	43	45	53	69	141	119	260
0256N	27	17	14	15	18	23	17	70	87
0684P	17	13	11	11	13	18	0	66	66
0684V	NA	-	-	-	-	-	-	-	-
							631	255	886

Note: Underlined cost represent facilities in place.

KEY TO C&TT STEPS

A: Alkaline Chlorination
B: Neutralization with Acid
C: Neutralization with Polymer
D: Thickener
E: Vacuum Filter

TABLE VIII-9

ALTERNATIVE BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Scale Removal-Kolene	Model Size-TPD :	130
:	Batch and Continuous	Oper. Days/Year:	250
:	Specialty	Turns/Day :	2

Alternative C&TT Step	1		2			3		
	H	Total	I	H	Total	J	K	Total
Investment $ x 10^{-3}	140	140	42	140	182	1962	73.7	2035.7
Annual Cost $ x 10^{-3}								
Capital	6.0	6.0	1.8	6.0	7.8	84.4	3.2	87.6
Depreciation	14.0	14.0	4.2	14.0	18.2	196.3	7.4	203.7
Operation & Maintenance	4.9	4.9	1.4	4.9	6.3	68.7	77.9	146.6
Sludge Disposal	-	-	-	-	-	0.9	-	0.9
Energy & Power(1)	0.2	0.2	0.1	0.2	0.3	23.0	0.1(2)	23.1
Chemical Costs	-	-	0.1	-	0.1	-	-	-
Replacement Parts	-	-	-	-	-	-	-	-
TOTAL	25.1	25.1	7.6	25.1	32.7	373.3	88.6(2)	461.9

	Effluent Quality(3)	BAT Feed Effluent Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level	BAT No. 3 Effluent Level
	Flow, gal/ton	320	320	320	0
	Suspended Solids	25	15	15	-
	Hex. Chromium	0.05	0.05	0.05	-
	pH, Units	6-9	6-9	6-9	-
023	Chloroform	0.03	0.03	0.03	-
114	Antimony	0.10	0.10	0.10	-
115	Arsenic	0.025	0.025	0.025	-
118	Cadmium	0.01	0.01	0.01	-
119	Chromium	0.50	0.10	0.10	-
120	Copper	0.50	0.10	0.10	-
124	Nickel	0.50	0.10	0.10	-
125	Selenium	0.06	0.06	0.06	-
127	Thallium	0.20	0.10	0.10	-
128	Zinc	0.10	0.10	0.10	-

---

(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost, as a credit is supplied for existing process water power requirements.

(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

H: Filtration System	J: Evaporation System
I: Sulfide Addition	K: Recycle

TABLE VIII-10

ALTERNATIVE BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Scale Removal-Hydride
: Specialty

Model Size-TPD : 200
Oper. Days/Year: 270
Turns/Day : 3

Alternative	1		2			3		
C&TT Step	F	Total	G	F	Total	H	I	Total
Investment $ x 10^{-3}	94	94	30	94	124	916.5	18	934.5
Annual Cost $ x 10^{-3}								
Capital	4.0	4.0	1.3	4.0	5.3	39.4	0.8	40.2
Depreciation	9.2	9.4	3.0	9.4	12.4	91.7	1.8	93.7
Operation & Maintenance	3.3	3.3	1.1	3.3	4.4	32.1	0.7	32.8
Sludge Disposal	-	-	-	-	-	0.5	-	0.5
Energy & Power(1)	0.2	0.2	0.1	0.2	0.3	2.7	0.1(2)	2.8
Chemical Costs	-	-	0.1	-	0.1	-	-	-
Replacement Parts	-	-	-	-	-	-	-	-
TOTAL	16.9	16.9	5.6	16.9	22.5	166.4	3.4(2)	169.8

	Effluent Quality(3)	BAT Feed Effluent Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level	BAT No. 3 Effluent Level
	Flow, gal/ton	100	100	100	0
	Suspended Solids	25	15	15	-
	Dissolved Iron	1	0.20	0.20	-
	pH, Units	6-9	6-9	6-9	-
114	Antimony	0.80	0.20	0.10	-
118	Cadmium	0.10	0.05	0.05	-
119	Chromium	0.50	0.10	0.10	-
120	Copper	0.50	0.10	0.10	-
121	Cyanide	0.25	0.25	0.25	-
122	Lead	0.50	0.10	0.10	-
124	Nickel	0.50	0.10	0.10	-
125	Selenium	0.02	0.020	0.020	-
126	Silver	0.10	0.10	0.10	-
128	Zinc	0.20	0.10	0.10	-

---

(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost, as a credit is supplied for existing process water power requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

F: Filtration System
G: Sulfide Addition System
H: Multi-stage evaporation system
I: Recycle

TABLE VIII-11

RESULTS OF BCT COST TEST
SCALE REMOVAL SUBCATEGORY

A. Kolene

BCT Model: lbs/year removed = 2086.3
Cost of BCT-1* = $25,100 $/lb = 12.03 FAIL
* Includes the cost of all of the BCT-1 treatment components.

B. Hydride

BCT Model: lbs/year removed = 12830.6
Cost of BCT-1* = $16,900 $/lb = 1.32 PASS
* Includes the cost of all of the BCT-1 treatment components.

TABLE VIII-12

ALTERNATIVE NSPS AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Scale Removal-Kolene
: Batch & Continuous
: Specialty

Model Size-TPD : 130
Oper. Days/Year: 250
Turns/Day : 2

	Alternative 1								Alternative 2						
C&TT Step	A	B	C	D	E(2)	F(2)	G	Total	A	D	E(2)	F(2)	H(3)	G(3)	Total
Investment $ x 10^{-3}	49	47	56	49	4.4	82	110	397.4	49	49	4.4	82	57	110	351.4
Annual Costs $ x 10^{-3}															
Capital	2.1	2.0	2.4	2.1	0.2	3.5	4.7	17.1	2.1	2.1	0.2	3.5	2.5	4.7	15.1
Depreciation	4.9	4.7	5.6	4.9	0.4	8.2	11.0	39.7	4.9	4.9	0.4	8.2	5.7	11.0	35.1
Operation & Maintenance	1.7	1.6	2.0	1.7	0.2	2.9	3.9	13.9	1.7	1.7	0.2	2.9	2.0	3.9	12.3
Sludge Disposal	-	-	-	-	0.7	0.5	0.1	1.4	-	-	0.7	-	-	0.1	0.8
Energy & Power(1)	0.1	0.1	0.1	0.1	-	0.4	0.2	1.0	0.1	0.1	-	0.3	0.3	0.2	1.0
Chemical Cost	0.1	2.0	0.1	0.1	-	-	-	2.3	0.1	0.1	-	-	0.1	-	0.3
TOTAL	8.9	10.4	10.2	8.9	1.5	15.5	19.9	75.4	8.9	8.9	1.5	14.9	10.6	19.9	64.6

	Effluent Quality(4)	Feed Level	Alt. No.1 Effluent Level	Alt. No.2 Effluent Level
	Flow, gal/ton	200	200	200
	Suspended Solids	1480	15	15
	Hex. Chromium	500	0.05	0.05
	pH, Units	8-12	6-9	6-9
023	Chloroform	0.04	0.03	0.03
114	Antimony	0.10	0.10	0.10
115	Arsenic	0.030	0.025	0.025
118	Cadmium	0.01	0.01	0.01
119	Chromium	550	0.10	0.10
120	Copper	2.50	0.10	0.10
124	Nickel	2.50	0.10	0.10
126	Selenium	0.06	0.06	0.06
127	Thallium	0.25	0.10	0.10
128	Zinc	0.10	0.10	0.10

---

(1) Costs are all power unless otherwise noted.
(2)(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Acid addition	B: Sulfur Dioxide addition	C: Lime addition
D: Polymer addition	E: Settling basin	F: Vacuum Filter
G: Filtration	H: Precipitation with sulfide	

TABLE VIII-13

ALTERNATIVE NSPS AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Scale Removal-Hydride
: Specialty

Model Size-TPD : 200
Oper. Days/Year: 270
Turns/Day : 3

	Alternative 1							2 - Alternative 1 plus:	
C&TT Step	A	B	C	$D^{(2)}$	$E^{(2)}$	F	Total	G	Total (incl. Alt. 1 Costs)
Investment $\$ \times 10^{-3}$	43	39	39	3	60	53	237	41	278
Annual Cost $\$ \times 10^{-3}$									
Capital	1.8	1.7	1.7	0.1	2.6	2.3	10.2	1.8	12.0
Depreciation	4.3	3.9	3.9	0.3	6.0	5.3	23.7	4.1	27.8
Operation & Maintenance	1.5	1.4	1.4	0.1	2.1	1.9	8.3	1.4	9.7
Sludge Disposal	-	-	-	0.2	0.1	-	0.3	-	0.3
Energy & Power(1)	0.1	0.1	0.1	-	0.3	0.2	0.8	0.2	1.0
Chemical Costs	0.1	0.1	0.1	-	-	-	0.3	0.5	0.8
TOTAL	7.8	7.2	7.2	0.7	11.1	9.7	43.6	8.0	51.6

Effluent Quality(3)		Feed Level	Alt. No.1 Effluent Level	Alt. No.2 Effluent Level
	Flow, gal/ton	50	50	50
	Total Suspended Solids	1000	15	15
	Dissolved Iron	80	0.20	0.20
	pH, Units	8-12	6-9	6-9
114	Antimony	1.6	0.20	0.10
118	Cadmium	0.20	0.05	0.05
119	Chromium	10	0.10	0.10
120	Copper	1.5	0.10	0.10
121	Cyanide	2.0	0.25	0.25
122	Lead	2.0	0.10	0.10
124	Nickel	10	0.10	0.10
125	Selenium	0.05	0.02	0.02
126	Silver	0.20	0.10	0.10
128	Zinc	0.40	0.10	0.10

---

(1) Costs are all power unless otherwise noted.
(2) Treatment components are used in tandem.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Alkaline Chlorination	B: Acid Addition
C: Polymer Addition	D: Settling Basin
E: Vacuum Filter	F: Filtration
G: Precipitation with sulfide	

TABLE VIII-14

ALTERNATIVE PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Scale Removal-Kolene
: Batch & Continuous
: Specialty

Model Size-TPD : 130
Oper. Days/Year: 250
Turns/Day : 2

C&TT Step	Alternative 1								Alternative 2						
	A	B	C	D	E(2)	F(2)	G	Total	A	D	E(2)	F(2)	H(3)	G(3)	Total
Investment $ x 10^{-3}	61	56	68	61	6	105	137	494	61	61	6	105	76	137	446
Annual Cost $ x 10^{-3}															
Capital	2.6	2.4	2.9	2.6	0.3	4.5	5.9	21.2	2.6	2.6	0.3	4.5	3.3	5.9	19.2
Depreciation	6.1	5.6	6.8	6.1	0.6	10.5	13.7	49.4	6.1	6.1	0.6	10.5	7.6	13.7	44.6
Operation & Maintenance	2.1	2.0	2.4	2.1	0.2	3.7	4.8	17.3	2.1	2.1	0.2	3.7	2.6	4.8	15.6
Sludge Disposal	-	-	-	-	0.9	0.9	-	1.8	-	-	0.9	0.9	-	-	1.8
Energy & Power(1)	0.1	0.1	0.2	0.2	-	0.9	0.2	1.7	0.1	0.2	-	0.9	0.3	0.2	1.7
Chemical Costs	0.2	4.0	0.1	0.4	-	-	-	4.7	0.2	0.4	-	-	0.1	-	0.7
TOTAL	11.1	14.1	12.4	11.4	2.0	20.5	24.6	96.1	11.1	11.4	2.0	20.5	13.9	24.6	83.6

	Effluent Quality(4)	PSES Feed Level	PSES No.1 Effluent Level	PSES No.2 Effluent Level
	Flow, gal/ton	320	320	320
	Suspended Solids	1200	15	15
	Hex. Chromium	400	0.05	0.05
	pH, Units	8-12	6-9	6-9
023	Chloroform	0.03	0.03	0.03
114	Antimony	0.10	0.10	0.10
115	Arsenic	0.025	0.025	0.025
118	Cadmium	0.01	0.01	0.01
119	Chromium	450	0.10	0.10
120	Copper	2.00	0.10	0.10
124	Nickel	2.00	0.10	0.10
125	Selenium	0.06	0.06	0.06
127	Thallium	0.20	0.10	0.10
128	Zinc	0.10	0.10	0.10

---

(1) Costs are all power unless otherwise noted.
(2)(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Acid Addition
B: Sulfur Dioxide Addition
C: Lime Addition
D: Polymer Addition
E: Settling Basin (1 day detention)
F: Vacuum Filter
G: Filtration
H: Precipitation with

TABLE VIII-15

ALTERNATIVE PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Scale Removal-Hydride
: Specialty

Model Size-TPD : 200
Oper. Days/Year: 270
Turns/Day : 3

C&TT Step	A	B	C	D(2)	E(2)	F	Total	G	Total (incl. A-F)
	Alternative 1							2 - Alternative 1 plus:	
Investment $ x 10^{-3}	56	50	48	4	59	94	311	50	361
Annual Cost $ x 10^{-3}									
Capital	2.4	2.1	2.1	0.2	2.5	4.0	13.4	2.2	15.6
Depreciation	5.6	5.0	4.8	0.4	5.9	9.4	31.1	5.0	36.1
Operation & Maintenance	2.0	1.7	1.7	0.1	2.0	3.3	10.9	1.8	12.7
Sludge Disposal	-	-	-	0.2	-	-	0.2	-	0.2
Energy & Power(1)	0.2	0.1	0.1	-	0.2	0.2	0.8	0.3	1.1
Chemical Costs	0.2	0.1	0.2	-	-	-	0.5	0.1	0.6
TOTAL	10.4	9.0	8.9	0.9	10.6	16.9	56.9	9.4	66.3

	Effluent Quality(3)	PSES Feed Level	PSES No.1 Effluent Level	PSES No.2 Effluent Level
	Flow, gal/ton	100	100	100
	Suspended Solids	500	15	15
	Dissolved Iron	40	0.20	0.20
	pH (Units)	8-12	6-9	6-9
114	Antimony	0.80	0.20	0.10
118	Cadmium	0.10	0.05	0.05
119	Chromium	5.0	0.10	0.10
120	Copper	0.75	0.10	0.10
121	Cyanide	1.0	0.25	0.25
122	Lead	1.0	0.10	0.10
124	Nickel	5.0	0.10	0.10
125	Selenium	0.025	0.02	0.02
126	Silver	0.10	0.10	0.10
128	Zinc	0.20	0.10	0.10

---

(1) Costs are all power unless otherwise noted.
(2) Treatment components are used in tandem.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A:	Alkaline Chlorination	B:	Acid Addition
C:	Polymer Addition	D:	Settling Basin
E:	Vacuum Filter	F:	Filtration
G:	Precipitation with sulfide		

SCALE REMOVAL SUBCATEGORY

SECTION IX

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

Introduction

As described below, the proposed best practicable control technology currently available (BPT) limitations are different than those promulgated in March 1976 for scale removal operations. The limitation for dissolved chromium has been replaced by one for total chromium, and the limitation for cyanide has been deleted for kolene operations. The March 1976 development document[1] describes how the originally promulgated limitations were developed. The change to total chromium has been made because this pollutant is now included on the toxic pollutant list. Cyanide was removed from the list of limited pollutants for kolene operations because it was not found in significant quantities. A review of the treatment processes and effluent limitations associated with the scale removal subcategory follows.

Identification of BPT

Based upon the information contained in Sections III through VIII of this report, the proposed BPT limitations for the scale removal operations are based upon the following treatment technologies.

A. Kolene Scale Removal

Acidification followed by chemical reduction with sulfur dioxide, sodium metabisulfate or sodium hydrosulfite. Oil separation or skimming, neutralization with lime, and chemical precipitation with polymer followed by settling in a thickener. Sludges are dewatered in vacuum filters.

B. Hydride Scale Removal

Chemical oxidation with chlorine, neutralization with acid, and chemical precipitation with polymer followed by settling in a thickener. Sludges are dewatered in vacuum filters.

Figures IX-1 and IX-2 depict the treatment systems described above.

---

[1] EPA 440/1-76/048-b, Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Steelmaking Segment of the Iron and Steel Manufacturing Point Source Category.

The proposed BPT limitations do not require the installation of the model treatment system. Any treatment system which achieves the proposed limitations is acceptable. The proposed BPT effluent limitations, which represent 30-day average values, are presented below:

Kolene	kg/kkg of Product
Total Suspended Solids	0.0521
Dissolved Iron	0.0021
Hexavalent Chromium	0.00010
Chromium (Total)	0.0010
pH	6.0-9.0

Hydride	kg/kkg of Product
Total Suspended Solids	0.125
Dissolved Iron	0.0050
Hexavalent Chromium	0.00030
Chromium (Total)	0.0025
Cyanide (Total)	0.0013
pH	6.0-9.0

The proposed maximum daily effluent limitations are three times the average values presented above.

Rationale for BPT Treatment System

As noted in Section VII, each of the components included in the BPT model treatment system are in use in a number of scale removal operations.

Justification of Proposed BPT Effluent Limitations

Tables IX-1 and IX-2 present sampled plant effluent data which support the proposed effluent limitations.

TABLE IX-1

JUSTIFICATION OF BPT EFFLUENT LIMITATIONS
SCALE REMOVAL SUBCATEGORY
KOLENE

	Effluent Limitations (kg/kkg)						
	TSS	D.Iron	Hex.Ch.	Chromium	Cyanide	pH	C&TT Components(1)
BPT Effluent Limitations (3/76)	0.0521	0.0021	0.00010	0.0010(2)	0.00050	6.0-9.0	CR,SS,NL,FLP,T,VF
Revised Effluent Limitations	0.0521	0.0021	0.00010	0.0010(3)	NL	6.0-9.0	CR,SS,NL,FLP,T,VF
Actual BPT Loads							
Plant Code							
131 (0424)	0.037	NA	**	*	∼0	9.4	VF,CR,NL,NW,NA,CL,SL,T
132 (0176)	0.024	0.0012	0.000062	0.00026	∼0	7.6	CNT(17),CR,PSP,NA,CO,CLA,EB,FLP,NC,NW,SL,CL,SSP,T,SS,CY

---

(1) For C&TT Code definitions, see Table VII-1.
(2) Dissolved Chromium limitation.
(3) 119 Chromium (total) limitation.

* : Limitation not supported.
**: Unreliable sample analysis.
NA: Not analyzed.
NL: No limitation is being proposed.

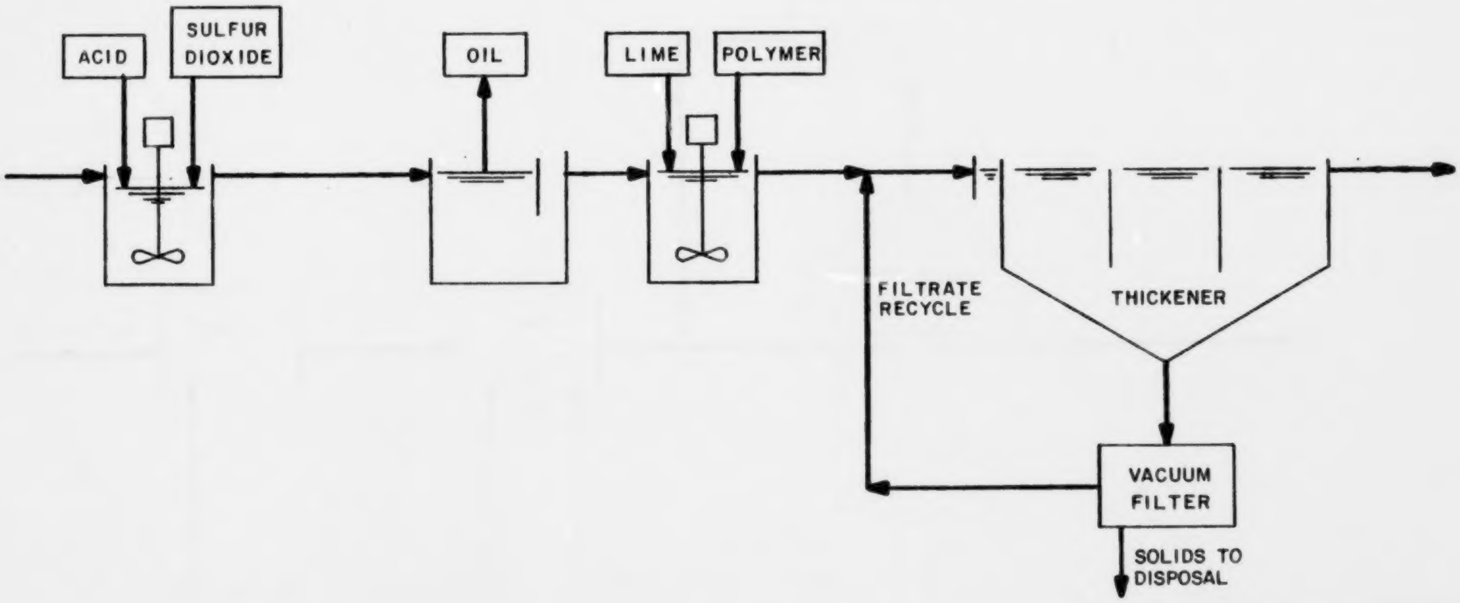
TABLE IX-2

JUSTIFICATION OF BPT EFFLUENT LIMITATIONS
SCALE REMOVAL SUBCATEGORY
HYDRIDE

	Effluent Limitations (kg/kkg)						
	TSS	D.Iron	Hex.Ch.	Chromium	Cyanide	pH	C&TT Components[1]
BPT Effluent Limitations (3/76)	0.125	0.0050	0.00030	0.0025[2]	0.0013	6.0-9.0	CLA,NA,FLP,T,VF
Revised Effluent Limitations	0.125	0.0050	0.00030	0.0025[3]	0.0013	6.0-9.0	CLA,NA,FLP,T,VF
Actual BPT Loads							
Plant Code							
139 (0256N)	0.00052	0.0000016	0.00025	0.00036	0.0000027	8.2	CLA,NA,SL,CNT(66)
132 (0176)	0.0040	0.00020	0.0000098	0.0000420	0.0000084	7.6	CNT(17),CR,PSP,NA,CO, CLA,EB,FLP,NC,NW,CL, SL,SCP,T,SS,CY

---

(1) For C&TT Code definition, see Table VII-1.
(2) Dissolved Chromium limitation.
(3) 119 Chromium (total) limitation.



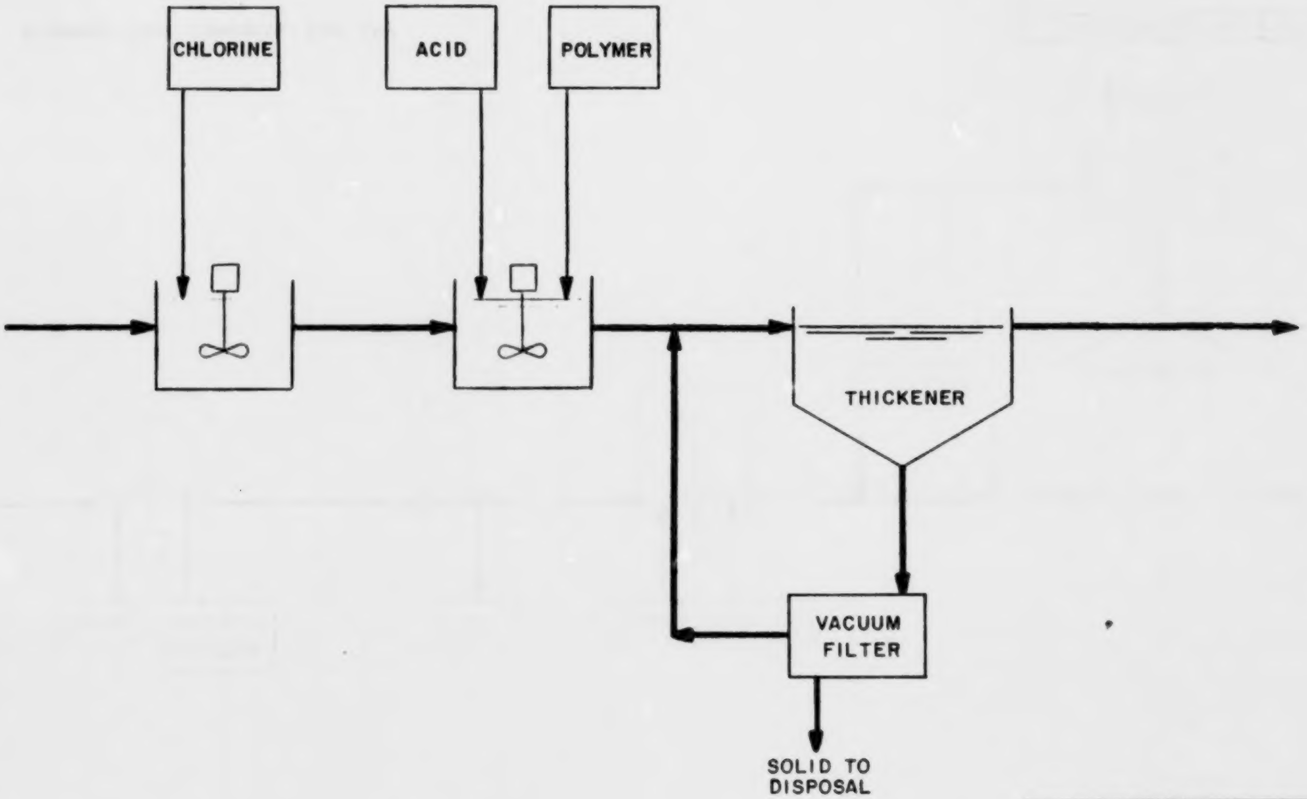
Discharge Flow Allowance: 500 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
BPT MODEL

Dwn.2/27/79

FIGURE IX - 1



Discharge Flow Allowance: 1200 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDRIDE SCALE REMOVAL
BPT MODEL

Dwn.3/3/79

FIGURE IX-2

SCALE REMOVAL SUBCATEGORY

SECTION X

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

Introduction

The Best Available Technology Economically Achievable (BAT) Effluent Limitations are to be attained by July 1, 1984. BAT is determined by reviewing subcategory practices and identifying the best economically achievable control and treatment technologies employed within the subcategory. In addition, where the technology is readily transferrable from one subcategory or industry, such technology may be identified as BAT.

This section identifies the BAT alternative treatment systems considered for the scale removal subcategory. The rationale for selecting the BAT alternative treatment systems is presented along with the proposed BAT limitations.

Identification of BAT

Based upon the information contained in Sections III through VIII, the Agency developed the following treatment technologies (as add-ons to the BPT model treatment system) for BAT for kolene and hydride scale removal operations.

Kolene Scale Removal

1. BAT Alternative No.1

   The BPT effluent would be filtered to remove particulate toxic metals. The capital and operating costs for this alternative are presented in Table VIII- 5. The treatment scheme is illustrated in Figure X-1.

2. BAT Alternative No.2

   The addition of sulfide is used to further reduce the levels of toxic metal pollutants prior to filtration. The capital and operating costs for this system are presented in Table VIII-5. The treatment scheme is illustrated in Figure X-1.

3. BAT Alternative No.3

   An evaporative system was considered to achieve zero discharge for kolene lines, consisting of a multi-stage evaporator, a condenser and a centrifuge to dewater the slurry generated in the process. The distillate produced would be recycled back to the scale removal operation.

The capital and operating costs are presented in Table VIII-5. The treatment system for this alternative is diagrammed in Figure X-1.

Hydride Scale Removal

Figure X-2 illustrates the three alternative treatment systems considered for the hydride scale removal subdivision. These models are identical to those considered for kolene operations. The respective investment and operating costs are presented in Table VIII-6.

The treatment systems shown in Figures X-1 and X-2 represent those technologies in use at one or more plants, or demonstrated in other wastewater treatment applications, and considered to be capable of attaining the respective BAT effluent levels.

The BAT limitations for each alternative treatment system are presented in Tables X-1 and X-2 for kolene and hydride operations, respectively. The selection of pollutants considered for limitation was based upon the following factors: presence as BPT limited pollutants; treatability using the technologies presented in the alternatives; quantity and toxicity in relation to the other process wastewater pollutants; and finally, the ability to serve as indicators of both the presence and the removal of other pollutants.

Analytical data indicate that total chromium is found at much higher levels and in greater quantities than other toxic pollutants found in kolene wastewaters, and that total chromium, lead and total cyanide are found at much higher levels and in greater quantities than other toxic pollutants found in hydride wastewaters. Based upon the above, the Agency is proposing BAT limitations for total chromium for kolene operations and limitations for total chromium, lead, and total cyanide for hydride operations. While other toxic metal pollutants have been found in scale removal wastewaters, the control of the limited toxic metals (Tables X-1 and X-2) will also result in the control of those toxic metal pollutants.

Flows

A. Kolene Scale Removal Operations

Table X-3 summarizes the usable flow data for kolene scale removal operations. The average of the best discharge flows was 322 gal/ton. The model flow selected by the Agency for BAT was 320 gal/ton. The average discharge flow was calculated using all available data from plants discharging less than 1000 gal/ton. The model BAT flow of 320 gal/ton is well demonstrated within this subcategory.

B. Hydride Scale Removal Operations

Table X-4 summarizes the usable flow data for hydride scale removal operations. The average of the best discharge flows was 112 gal/ton. The model flow selected by the Agency for BAT was

100 gal/ton. The average discharge flow was calculated using all available data from plants discharging less than 600 gal/ton. The recommended flow of 100 gal/ton is well demonstrated within this subcategory.

Wastewater Quality

Following are the average effluent concentrations achievable with each BAT alternative treatment system (the maximum values are expressed in parentheses).

Kolene Scale Removal Operations

Concentration Basis, mg/l	BAT Alt. No. 1	BAT Alt. No. 2	BAT Alt. No. 3
Chromium (Total)	0.10 (0.30)	0.10 (0.30)	-

Hydride Scale Removal Operations

Concentration Basis, mg/l	BAT Alt. No.1	BAT Alt. No.2	BAT Alt. No.3
Chromium (Total)	0.10 (0.30)	0.10 (0.30)	-
Cyanide (Total)	0.25 (0.75)	0.25 (0.75)	-
Lead (Total)	0.10 (0.30)	0.10 (0.30)	-

These lists contain all of the toxic pollutants considered for limitation at BAT. Reference is made to Appendix A of Volume I for the derivation of the above concentrations.

Effluent Limitations for BAT Alternatives

The effluent limitations for each BAT alternative treatment system were calculated by multiplying the model effluent flow by the pollutant concentrations and an appropriate conversion factor. Tables X-1 and X-2 present the effluent limitations developed for each alternative treatment system.

Selection of a BAT Alternative

The Agency selected BAT Alternative No. 1 as the BAT model treatment system for both hydride and kolene operations. Filtration is demonstrated in the Scale Removal Subcategory while sulfide precipitation and evaporation techniques are not. For this reason the Agency selected the first alternative as the model treatment systems upon which the proposed BAT effluent limitations are based.

The proposed BAT effluent limitations are presented in Tables X-1 and X-2.

TABLE X-1

BAT EFFLUENT LIMITATIONS GUIDELINES
KOLENE SCALE REMOVAL

		BAT Alternative 1*		BAT Alternative 2		BAT Alternative 3	
		Concentration Basis (mg/l)	Effluent Limitations (kg/kkg)	Concentration Basis (mg/l)	Effluent Limitations (kg/kkg)	Concentration Basis (mg/l)	Effluent Limitations (kg/kkg)
Discharge Flow (Gal/Ton)		320	-	320	-	0	-
Chromium (Total)	Ave.	0.10	0.00013	0.10	0.00013	-	-
	Max.	0.30	0.00039	0.30	0.00039	-	-

---

* : Selected BAT alternative.

TABLE X-2

BAT EFFLUENT LIMITATIONS GUIDELINES
HYDRIDE SCALE REMOVAL

		BAT Alternative 1*		BAT Alternative 2		BAT Alternative 3	
		Concentration Basis (mg/l)	Effluent Limitations (kg/kkg)	Concentration Basis (mg/l)	Effluent Limitations (kg/kkg)	Concentration Basis (mg/l)	Effluent Limitations (kg/kkg)
Discharge Flow (Gal/Ton)		100	-	100	-	0	-
Chromium (Total)	Ave.	0.10	0.000042	0.10	0.000042	-	-
	Max.	0.30	0.00013	0.30	0.00013	-	-
Cyanide (Total)	Ave.	0.25	0.00010	0.25	0.00010	-	-
	Max.	0.75	0.00030	0.75	0.00030	-	-
Lead (Total)	Ave.	0.10	0.000042	0.10	0.000042	-	-
	Max.	0.30	0.00013	0.30	0.00013	-	-

---

* : Selected BAT alternative.

TABLE X-3

SUMMARY OF FLOW DATA
KOLENE SCALE REMOVAL

Recommended Flow Value: 320 GPT

Plant Code	Plant Type	Discharge Flow (GPT)	Basis
020B-01	B	91	308 Data
284A	C	104	308 Data
684D	C	167	Sampled Data
528-02	C	235	308 Data
432K	C	280	Sampled Plant
440A-01	B	342	Sampled Plant
060I	B	380	308 Data
776H	B	391	308 Data
528-04	C	400	308 Data
176-04	B	461	Sampled Plant
424-01	B	494	Sampled Plant
528-05	C	617	308 Data
528-03	C	667	308 Data
248D	B	1026*	308 Data
776G	B	1283*	308 Data
430C	B	1467*	308 Data
088A-02	B	1533*	308 Data
088A-01	B	1774*	308 Data
856E	B	1846*	308 Data

Average of all mills(1): 656 GPT
Average of the Best(1) : 322 GPT ~ 320 GPT

---

(1) Data specified as confidential by certain plants were included when calculating averages.

B: Batch
C: Continuous
*: Value not included in Average of the Best

TABLE X-4

SUMMARY OF FLOW DATA
HYDRIDE SCALE REMOVAL

Recommended Flow Value: 100 GPT

Plant Code	Discharge Flow (GPT)	Basis
256N-01	1.8	Sampled Plant
684P	33	308 Data
256K	87	308 Data
176-02	330	308 Data
176-01	611*	Sampled Plant
440A	1200*	Sampled Plant
176-03	1818*(1)	308 Data

Average of all mills: 583 GPT
Average of the Best : 112 BPT ~ 100 GPT

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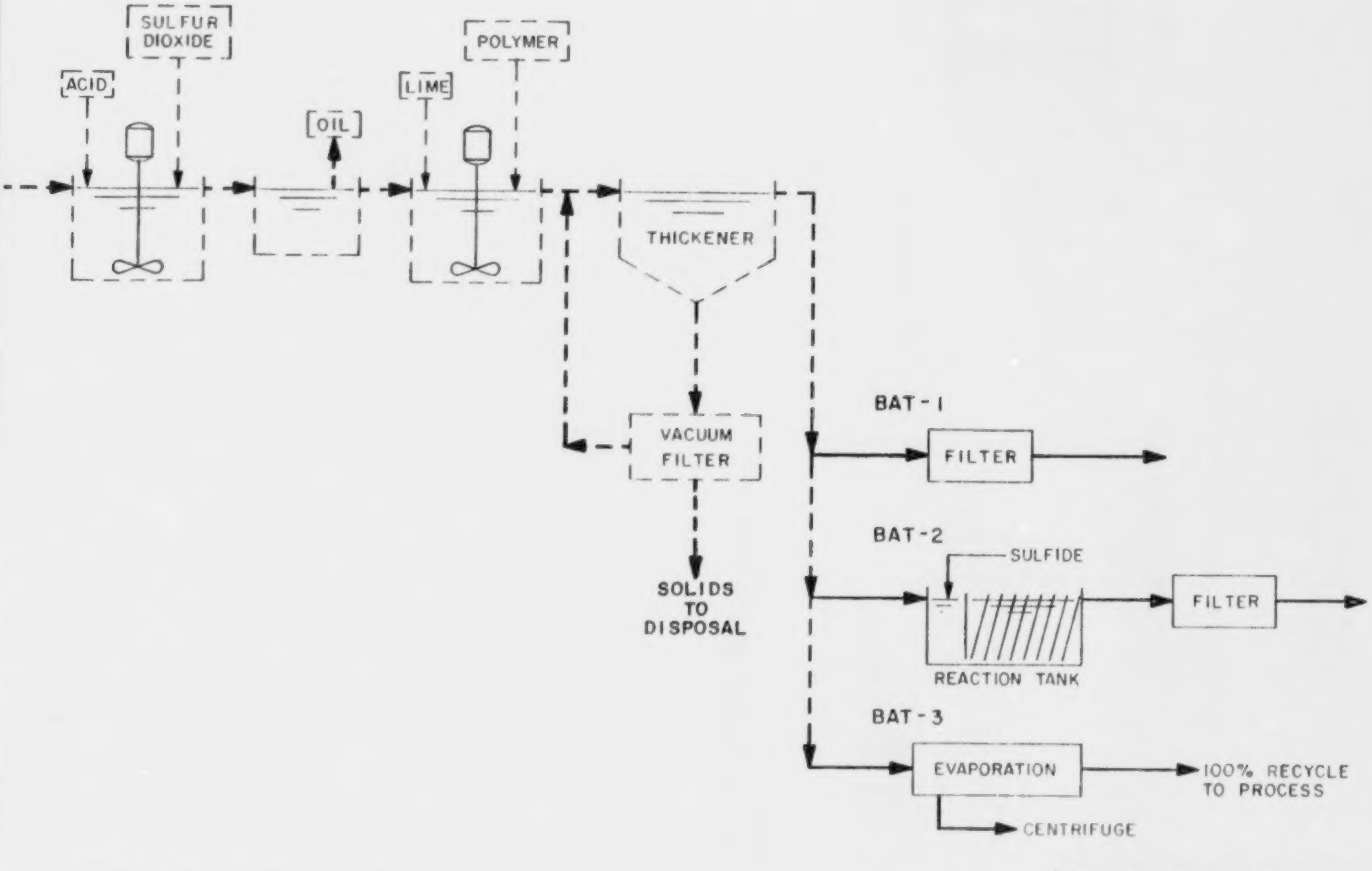
(1) Only continuous plant.
*: Values not included in Average of the Best.



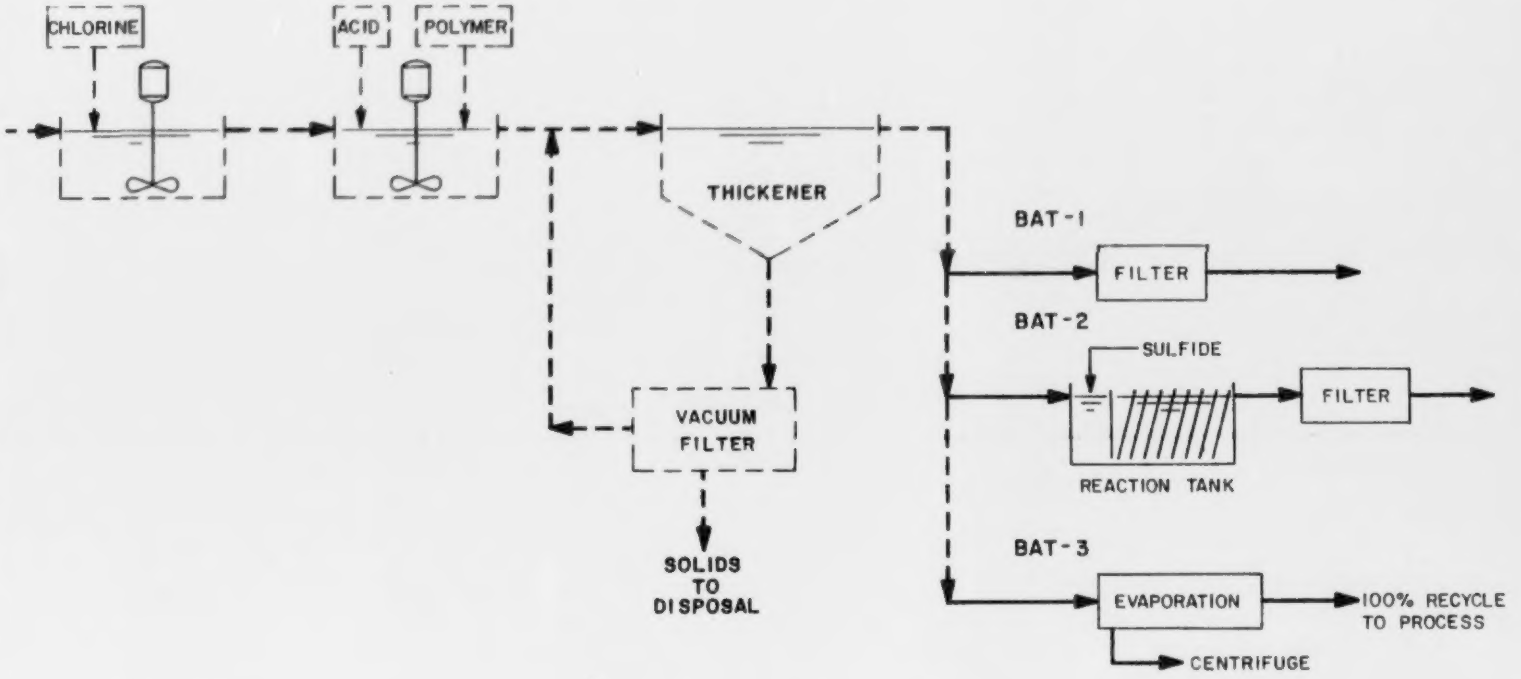
Discharge Flow Allowance: 320 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
BAT TREATMENT MODEL
ALTERNATIVES 1-3

Dwn. 6/16/80

FIGURE X-1



Discharge Flow Allowance: 100 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDRIDE SCALE REMOVAL
BAT TREATMENT MODEL
ALTERNATIVES 1-3

Dwn.6/16/80

FIGURE X-2

SCALE REMOVAL SUBCATEGORY

SECTION XI

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY (BCT)

Introduction

The 1977 Amendments added Section 301(b)(4)(E) to the Act, establishing "best conventional pollutant control technology" (BCT) for discharges of conventional pollutants from existing industrial point sources. Conventional pollutants are those defined in Section 304(g)(4) - BOD, TSS, fecal coliform and pH - and any additional pollutants defined by the Administrator as "conventional." On July 28, 1978, EPA proposed that COD, oil and grease, and phosphorus be added to the conventional pollutant list (43 Fed. Reg. 32857). Only oil and grease was added.

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. BCT requires that limitations for conventional pollutants be assessed in light of a new "cost-reasonableness" test, which involves a comparison of the cost and level of reduction of conventional pollutants from the discharge of POTWs to the cost and level of reduction of such pollutants from a class or category of industrial sources. As part of its review of BAT for certain "secondary" industries, EPA proposed methodoloy for this cost test. (See 43 Fed. Reg. 37570, August 23, 1978).

Development of BCT

The reference POTW treatment cost for the conventional pollutants is \$1.34/lb. An explanation of this cost is presented in Section X of Volume I. Figures XI-1 and XI-2 present the scale removal subcategory BCT alternative treatment systems. As shown, filtration of the BPT effluent is the BCT alternative treatment system for each descaling operation. The conventional pollutant treatment costs are summarized below.

	BCT Alternative
Kolene	\$12.03/lb
Hydride	\$ 1.32/lb

Selection of a BCT Alternative

Kolene Scale Removal Operations

The BCT model treatment system does not pass the BCT cost test. Therefore, the BCT limitations are the same as the proposed BPT limitations. Table XI-1 presents the proposed BCT limitations for kolene operations.

Hydride Scale Removal Operations

The BCT model treatment system passes the BCT cost test. The model treatment system employs the same treatment components as BAT Alternative No. 1. The BCT treatment costs are identical to those presented in Section VIII for BAT Alternative No. 1. Table XI-2 presents the proposed BCT limitations for hydride operations.

Development of BCT Limitations

The Agency is proposing limitations for suspended solids and pH at both BPT and BCT. For kolene operations, those limitations are the same. For the hydride operations, the effluent levels for suspended solids are based on the BCT treatment system which employs filtration technology. Refer to the discussion on filtration capabilities in Volume I for the rationale for the concentration values for TSS used to develop the proposed BCT limitations. The pH levels proposed at BCT are the same at those proposed for BPT.

TABLE XI-1

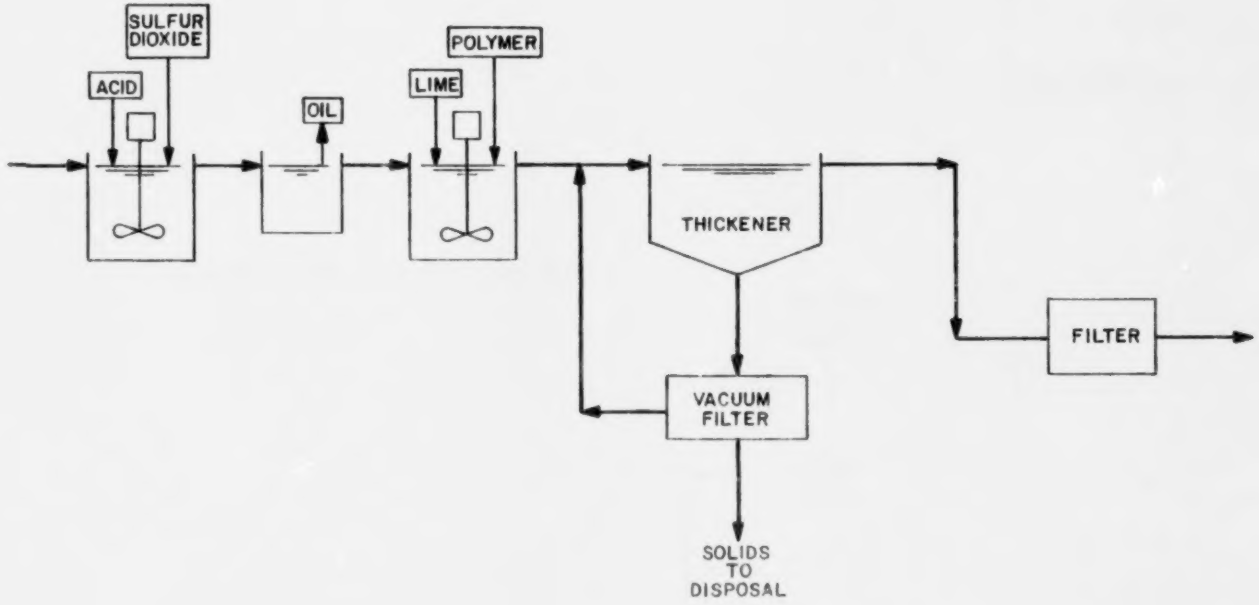
BCT EFFLUENT LIMITATIONS
KOLENE SCALE REMOVAL

		BCT Effluent Limitations (kg/kkg)
Discharge Flow (Gal/ton)		500
Total Suspended Solids	Avg.	0.0521
	Max.	0.156
pH, Units		6.0-9.0

TABLE XI-2

BCT EFFLUENT LIMITATIONS
HYDRIDE SCALE REMOVAL

		BCT Effluent Limitations (kg/kkg)
Discharge Flow (Gal/ton)		100
Total Suspended Solids	Avg.	0.0062
	Max.	0.0168
pH, Units		6.0-9.0



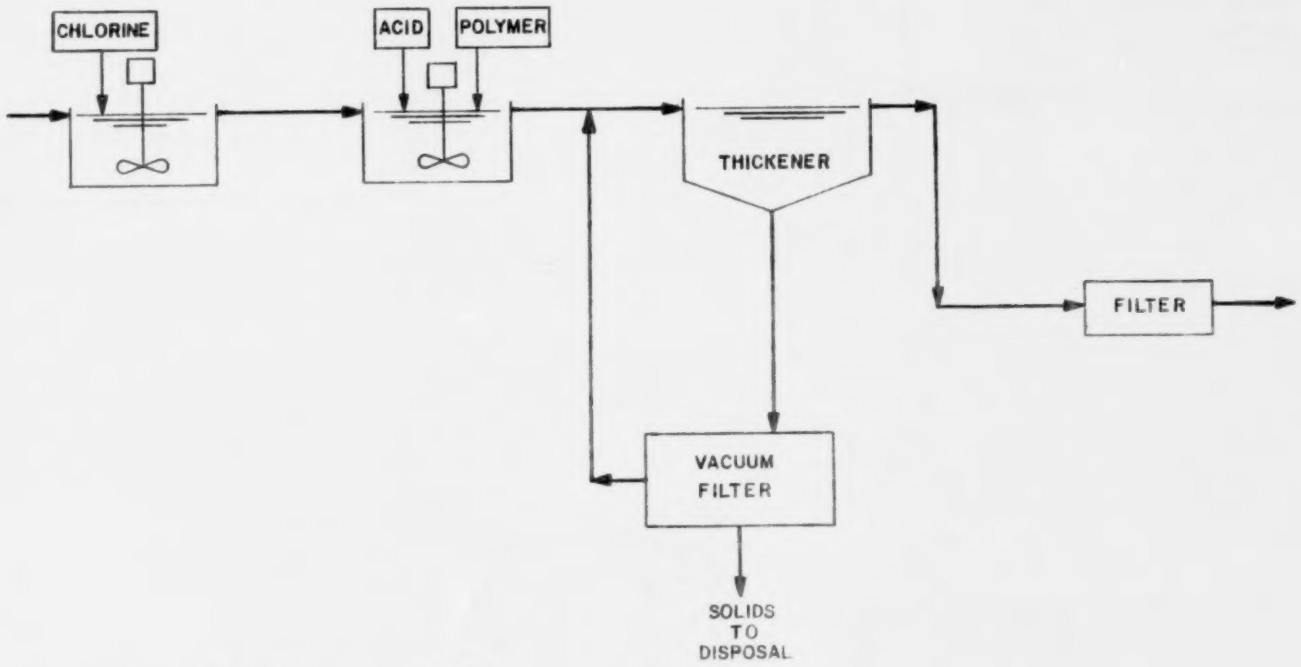
Discharge Flow Allowance 320 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
BCT TREATMENT MODEL

Dwn 11/12/80

FIGURE XI-1



Discharge Flow Allowance: 100 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDRIDE SCALE REMOVAL
BCT TREATMENT MODEL

Dwn. 11/12/80

FIGURE XI-2

SCALE REMOVAL SUBCATEGORY

SECTION XII

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF NEW SOURCE PERFORMANCE STANDARDS

Introduction

A new source is defined as any source constructed after the proposal of New Source Performance Standards (NSPS). NSPS represents the degree of effluent reduction achievable through the application of the Best Available Demonstrated Control Technology (BADCT), process, operating methods, or other alternatives, including, where practicable, a standard permitting no discharge of pollutants.

For scale removal operations, a "no aqueous discharge of pollutants" limit is not readily attainable. Due to the nature of the rinsing or quenching steps, scale removal wastewaters cannot usually be reused or recycled. Only if scale removal wastewaters are discharged to a large central treatment system is reuse considered viable. However, this reuse will not result in zero discharge. This mode of treatment is not recommended for new source operations. However, substantial flow and pollutant load reductions are being considered for NSPS.

Identification of NSPS

Kolene Scale Removal Operations

A. NSPS Alternative No.1

Flows are reduced to the best demonstrated flow rate (200 gal/ton). Acid and sulfur dioxide are added to the waste stream in order to provide hexavalent chromium reduction. Following neutralization with lime, the wastewaters are aerated to sparge any excess sulfur dioxide. Polymer is added prior to sedimentation in a settling basin, from which surface oils and scums are skimmed for further disposal. Sludges generated in the treatment process are dewatered in a vacuum filter. Further solids removal is then provided in a filtration step. The capital and operating costs for this alternative are presented in Table VIII-8. The treatment system is diagrammed in Figure XII-1.

B. NSPS Alternative No.2

As outlined in NSPS Alternative No.1, process discharge flows are reduced to the best demonstrated level. Acid is then added for the purpose of pH adjustment, followed by the addition of polymer and sulfide. Sulfide not only helps to precipitate various metals, but also reduces hexavalent chromium to its trivalent form. Sedimentation is provided in a settling basin with the sludges being dewatered in a vacuum filter. Further solids removal is then provided with a filtration step. The capital and operating costs for this alternative are presented in Table VIII-8. The treatment scheme is diagrammed in Figure XII-2.

Hydride Scale Removal Operations

A. NSPS Alternative No.1

Flows are reduced to the level of the best demonstrated flow rate (50 gal/ton). Chlorine is added to the alkaline process wastewaters to destroy (oxidize) the cyanide. Acid is then added to provide a neutral pH. Polymer is added prior to sedimentation in a settling basin. The sludges generated in the treatment process are dewatered in a vacuum filter. Further solids removal is then provided with a filtration step. The capital and operating costs for this alternative are presented in Table VIII-9. The treatment scheme is diagrammed in Figure XII- 3.

B. NSPS Alternative No.2

The flows are reduced to the same level as in NSPS Alternative No.1 above. Also, as in Alternative No.1, chlorine is added to destroy any cyanide which may be present. Acid is then added for the purpose of pH neutralization, followed by the addition of polymer and sulfide. Sulfide is used to precipitate various toxic metal pollutants. Sedimentation is provided in a settling basin with the sludges being dewatered in a vacuum filter. Further solids removal is then provided with a filtration step. The capital and operating costs for this alternative are presented in Table VIII-9. Figure XII-3 diagrams the treatment system.

Rationale for Selection of NSPS

The NSPS alternative treatment systems for the scale removal subcategory are similar to the BPT model and BAT alternative treatment systems described in Sections IX and X. The rationale presented in these sections is applicable to NSPS.

Both NSPS treatment alternatives for kolene scale removal and hydride scale removal are addressed below.

Treatment Scheme

As noted in Section X, the use of filtration technology is demonstrated not only within the steel industry, but also within the scale removal subcategory. The second alternative for kolene operations eliminates the addition of sulfur dioxide and lime. Instead, sulfide is added prior to final filtration. Sulfide not only helps to precipitate various metals, but under proper conditions also reduces hexavalent chromium to its trivalent form. The addition of sulfur dioxide and lime then becomes unnecessary. With the exception of this sulfide precipitation, the other treatment technologies are also well demonstrated within the scale removal subcategory. As discussed in Section X, sulfide precipitation has been successfully applied to the treatment of other metals manufacturing process wastewaters and is considered suitable for the treatment of the various steel industry process wastewaters as well. The recommended treatment technologies are reliable and demonstrated methods of treatment and are, thus, appropriate for use in NSPS treatment systems.

The resulting effluent wastewater quality for NSPS alternatives are presented in Tables XII-1 and XII-2, for kolene and hydride, respectively. As noted in Section X, the effluent levels were based upon the capabilities of the various wastewater treatment technologies. The pollutants listed on Tables XII-1 and XII-2 include only those pollutants proposed for limitation at BAT and BCT (refer to Section X for the factors considered in selecting these pollutants).

Flows

The discharge flows developed for NSPS are 200 gal/ton for kolene descaling, and 50 gal/ton for hydride descaling. These flow rates are well demonstrated within the respective scale removal operations.

Selection of NSPS Alternative

The Agency selected NSPS Alternative No.1 as the NSPS model treatment system. NSPS Alternative No. 1 was selected for the same reason noted in the discussion in Section X regarding the selection of a BAT Alternative.

TABLE XII-1

NEW SOURCE PERFORMANCE STANDARDS SCALE REMOVAL SUBCATEGORY - KOLENE

		NSPS Alternative 1*		NSPS Alternative 2	
		Concentration Basis (mg/l)	Effluent Standards (kg/kkg)	Concentration Basis (mg/l)	Effluent Standards (kg/kkg)
Discharge Flow (Gal/Ton)		200	-	200	-
Total Suspended Solids	Ave.	15	0.013	15	0.013
	Max.	40	0.035	40	0.035
pH		6.0-9.0		6.0-9.0	
Chromium (Total)	Ave.	0.10	0.000084	0.10	0.000084
	Max.	0.30	0.00025	0.30	0.00025

---

* Selected NSPS alternative.

TABLE XII-2

NEW SOURCE PERFORMANCE STANDARDS SCALE REMOVAL SUBCATEGORY - HYDRIDE

		NSPS Alternative 1*		NSPS Alternative 2	
		Concentration Basis (mg/l)	Effluent Standards (kg/kkg)	Concentration Basis (mg/l)	Effluent Standards (kg/kkg)
Discharge Flow (Gal/Ton)		50	-	50	-
Total Suspended Solids	Ave.	15	0.0031	15	0.0031
	Max.	40	0.0082	40	0.0082
pH		6.0-9.0		6.0-9.0	
Chromium (Total)	Ave.	0.10	0.000021	0.10	0.000021
	Max.	0.30	0.000063	0.30	0.000063
Cyanide (Total)	Ave.	0.25	0.000052	0.25	0.000052
	Max.	0.75	0.00016	0.75	0.00016
Lead (Total)	Ave.	0.10	0.000021	0.10	0.000021
	Max.	0.30	0.000063	0.30	0.000063

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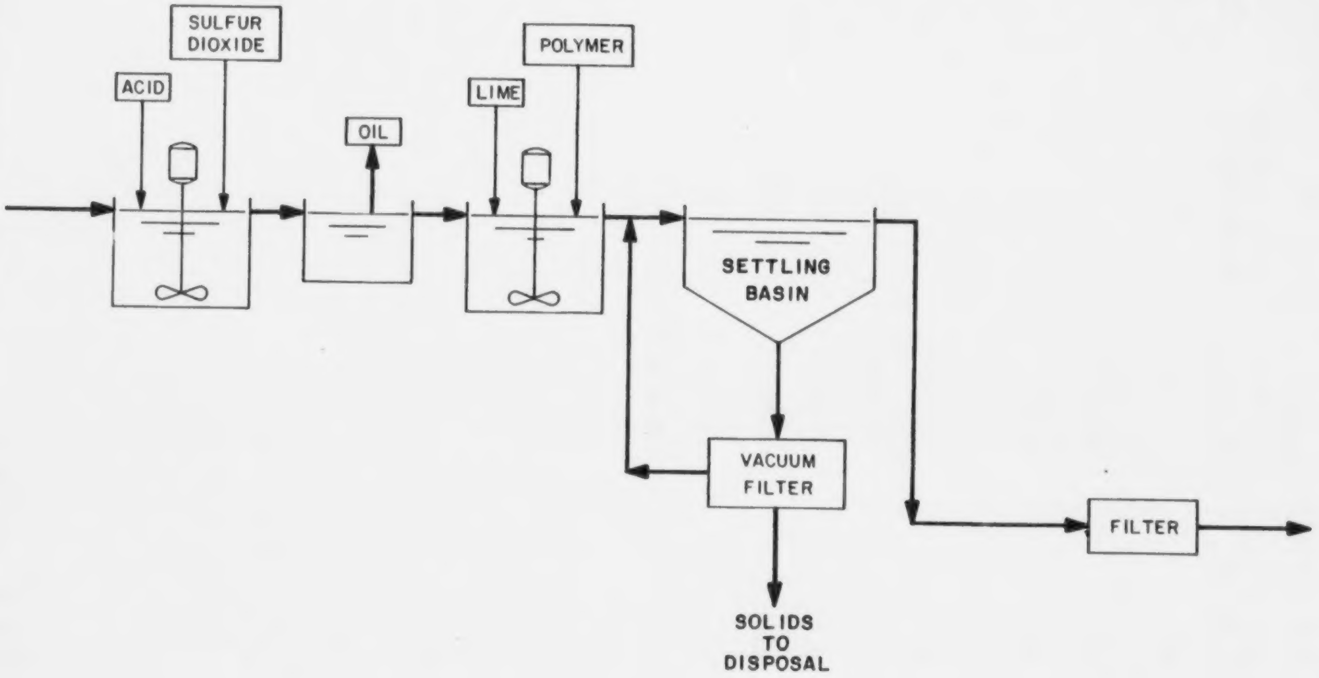
*: Selected NSPS alternative.



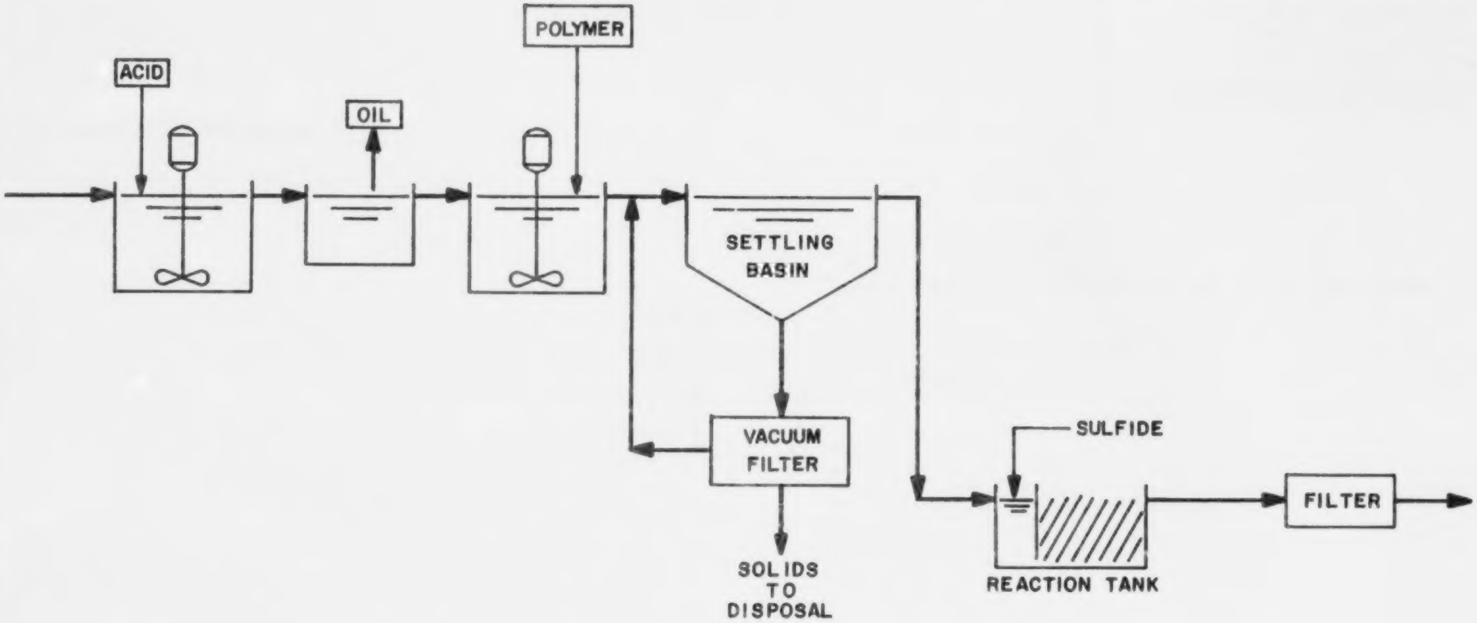
Discharge Flow Allowance: 200 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
NSPS MODEL-ALTERNATIVE I

Dwn. 6/16/80

FIGURE XII-1



Discharge Flow Allowance: 200 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
NSPS MODEL-ALTERNATIVE 2

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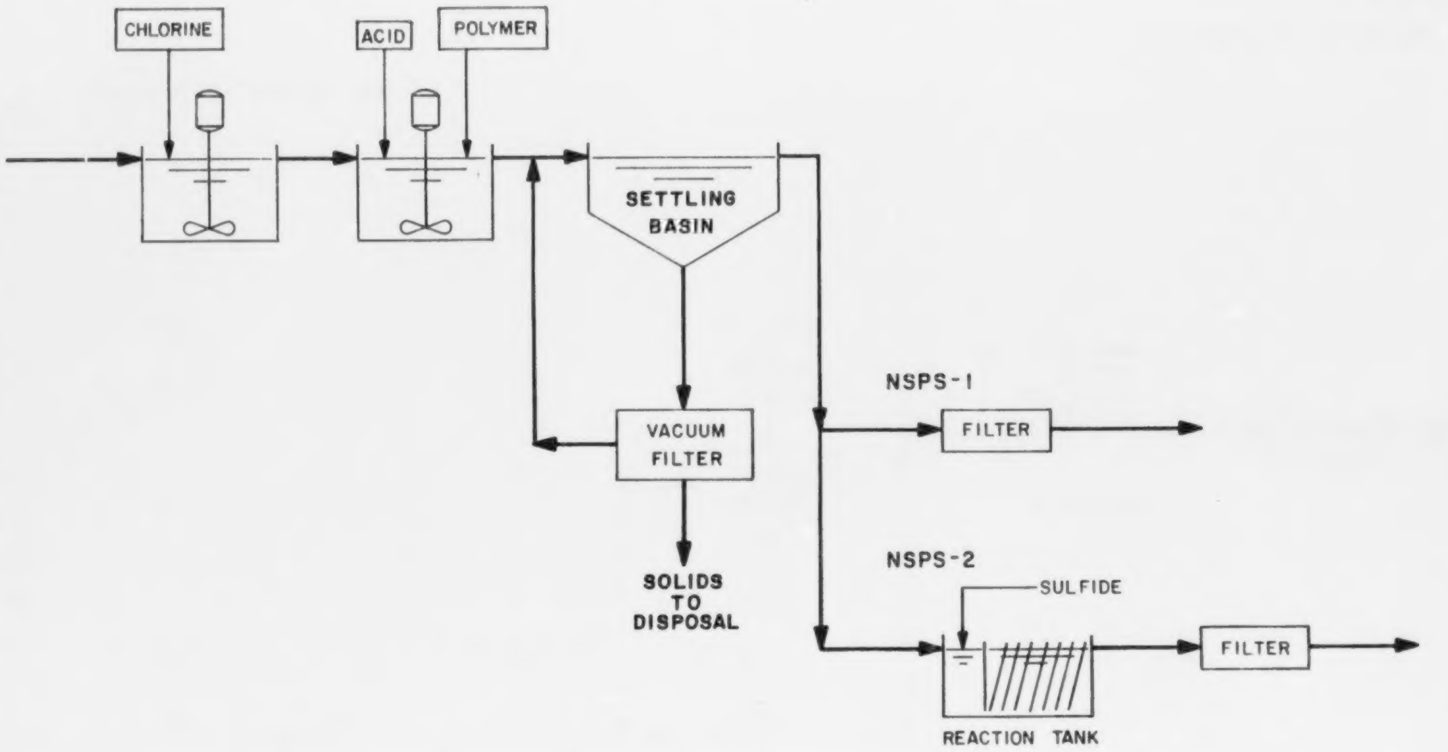
FIGURE XII-2



DISCHARGE FLOW ALLOWANCE: 50 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDRIDE SCALE REMOVAL
NSPS MODEL-ALTERNATIVES 1 & 2

Dwn. 6/17/80

FIGURE XII-3

SCALE REMOVAL SUBCATEGORY

SECTION XIII

PRETREATMENT STANDARDS FOR SCALE REMOVAL OPERATIONS DISCHARGING TO PUBLICLY OWNED TREATMENT WORKS

Introduction

This section discusses the alternative control and treatment systems available for scale removal operations which discharge wastewaters to publicly owned treatment works (POTWs). Separate consideration is given to pretreatment of scale removal process wastewaters from existing sources and from new sources.

The general pretreatment and categorical pretreatment standards applying to scale removal operations are discussed below.

General Pretreatment Standards

For detailed information on Pretreatment Standards, refer to 43 FR 27736-27773, "General Pretreatment Regulations for Existing and New Sources of Pollution," (June 26, 1978). In particular, 40 CFR Part 403 describes national standards (prohibited discharges and categorical standards), revision of categorical standards and POTW pretreatment programs.

In establishing pretreatment standards for scale removal operations, the Agency gave primary consideration to the objectives and requirements of the General Pretreatment Regulations. In addition, the Agency considered other factors which are specifically applicable to scale removal operations. These are discussed below.

The General Pretreatment Regulations set forth general discharge prohibitions that apply to all nondomestic users of a POTW to prevent pass-through of pollutants, interference with the operation of a POTW, and municipal sludge contamination. The regulations also establish administrative mechanisms to ensure application and enforcement of prohibited discharge limits and categorical pretreatment standards. In addition, the Regulations contain provisions relating directly to the determination of and reporting on Pretreatment Standards.

Wastewaters from several scale removal plants are discharged to POTWs. POTWs are usually not designed to treat the toxic pollutants which are present in scale removal wastewaters. Instead POTWs are designed to treat biochemical oxygen demand (BOD), suspended solids (SS), fecal coliform, bacteria, and pH. Whatever removal is obtained by POTWs for toxic pollutants is incidental to the POTWs main function of treating conventional pollutants. Thus, POTWs have historically accepted extremely large amounts of many pollutants well above their capacity to treat them adequately. As the issue of municipal sludge use has become more important, pretreatment standards must address toxic pollutant removal, rather than the transfer of these pollutants to POTWs where many pollutants concentrate in the sludges.

Due to the presence of toxic pollutants in wastewaters from scale removal, pretreatment must be provided to ensure that these pollutants do not interfere with, pass through, or are otherwise incompatible with POTW operations or cause harm to the treatment plant. In general, the pretreatment wastewater treatment technologies are the same as the BAT level treatments. The Agency is not proposing pretreatment standards for suspended solids because the amounts present in scale removal wastewaters are compatible with POTW operations and can be effectively treated at POTWs. Toxic pollutants are reviewed below.

Pretreatment Considerations for Scale Removal

Toxic Metals

As noted in Volume I, Section V, toxic metals such as chromium and lead are not destroyed in POTWs, but pass through to the effluent or are retained in the POTW sludge. They can interfere with POTW treatment processes and can limit the usefulness of POTW sludge for application to agricultural croplands. In a study of 240 POTWs, 56 percent of the primary plants allowed more than 80 percent pass through of chromium, and in a study of 214 POTWs, median pass through values for lead were over 80 percent for primary plants, and over 60 percent for trickling filter, activated sludge, and biological process plants. Hence, the proposed pretreatment standards for existing and new sources are the same as the proposed BAT and NSPS limitations and standards.

Total Cyanide

As noted in Volume I, cyanide compounds can interfere with the operation of and pass through POTWs, as well as enhance the toxicity of metals commonly found in POTW effluents. The mean pass through of cyanide for fourteen biological plants was found to be 71 percent. Hence, the Agency concludes that pretreatment standards for existing and new sources for total cyanide should be equal to the proposed BAT and NSPS limitations and standards, respectively.

Identification of Pretreatment

Existing Sources

Kolene

A. PSES Alternative No. 1

Acidification followed by chemical reduction with sulfur dioxide. Oil skimming or separation, neutralization with lime, and chemical precipitation with polymer followed by settling in a settling basin. Sludges are then dewatered in vacuum filters. An additional filtration system is employed to provide further reduction in the levels of toxic metal pollutants.

B. PSES Alternative No. 2

Acidification followed by chemical reduction with sulfur dioxide; followed by oil skimming or separation. Chemical precipiation with polymer followed by setting in a setting basin. Sludges are dewatered in vacuum filters. Sulfide is added in a reaction tank followed by an additional filtration system.

Hydride

A. PSES Alternative No. 1

Chemical oxidation with chlorine, neutralization with acid and chemical precipitation with polymer followed by settling in a settling basin. Sludges are dewatered in vacuum filter. An additional filtration system is employed to provide further reduction in levels of toxic metal pollutants.

B. PSES Alternative No. 1

Chemical oxidation with chlorine, neutralization and chemical precipitation followed by settling in a settiing basin, sludges are dewatered in vacuum filters. Sulfide is added in a reaction tank followed by an additional filtration system.

Figures XIII-1 through XIII-3 illustrate the model pretreatment systems for existing sources for kolene and hydride operations, and Tables XIII-1 and XIII- 2 present the respective PSES standards.

New Sources

The model pretreatment systems for new sources are identical to the corresponding model PSES systems outlined above. However, the discharge flows are reduced to the best demonstrated level noted in Section XII for NSPS. Figures XIII-4 through XIII-6 illustrate the pretreatment system for new sources for kolene and hydride operations, and Tables XIII-3 and XIII-4 present the respective PSNS standards.

Flow Rates

A summary of the flow rates considered for PSES and PSNS is presented below.

	Kolene	Hydride
PSES	320 gal/ton	100 gal/ton
PSNS	200 gal/ton	50 gal/ton

Selection of Pretreatment Alternatives

The Agency selected pretreatment Alternative No. 1 as the PSES model treatment system for both kolene and hydride operations. PSES Alternative No. 1 and PSNS Alternative No. 1 were selected for kolene operations for the same reason noted in Section XII for the selection of the NSPS Alternative for kolene operations. PSES Alternative No. 1 and PSNS Alternative No. 1 were selected for hydride operations for the same reasons noted in Section X regarding the selection of a BAT alternative.

TABLE XIII-1

PRETREATMENT EFFLUENT STANDARDS FOR EXISTING SOURCES SCALE REMOVAL SUBCATEGORY - KOLENE

		PSES Alternative 1*		PSES Alternative 2	
		Concentration Basis (mg/l)	Effluent Standards (kg/kkg)	Concentration Basis (mg/l)	Effluent Standards (kg/kkg)
Discharge Flow (Gal/Ton)		320	-	320	-
Chromium (Total)	Ave.	0.10	0.00013	0.10	0.00013
	Max.	0.30	0.00039	0.30	0.00039

---

* Selected PSES alternative.

TABLE XIII-2

PRETREATMENT EFFLUENT STANDARDS FOR EXISTING SOURCES SCALE REMOVAL SUBCATEGORY - HYDRIDE

		PSES Alternative 1*		PSES Alternative 2	
		Concentration Basis (mg/l)	Effluent Standards (kg/kkg)	Concentration Basis (mg/l)	Effluent Standards (kg/kkg)
Discharge Flow Flow (Gal/Ton)		100	-	100	-
Chromium (Total)	Ave.	0.10	0.000042	0.10	0.000042
	Max.	0.30	0.000013	0.30	0.000013
Cyanide (Total)	Ave.	0.25	0.00010	0.25	0.00010
	Max.	0.75	0.00030	0.75	0.00030
Lead (Total)	Ave.	0.10	0.000042	0.10	0.000042
	Max.	0.30	0.00013	0.30	0.000013

---

*: Selected PSES Alternative.

TABLE XIII-3

PRETREATMENT EFFLUENT STANDARDS FOR NEW SOURCES SCALE REMOVAL SUBCATEGORY - KOLENE

		PSNS Alternative 1*		PSNS Alternative 2	
		Concentration Basis (mg/l)	Effluent Standards (kg/kkg)	Concentration Basis (mg/l)	Effluent Standards (kg/kkg)
Discharge Flow (Gal/Ton)		200	-	200	-
Chromium (Total)	Ave.	0.10	0.000084	0.10	0.000084
	Max.	0.30	0.00025	0.30	0.00025

---

* Selected PSNS alternative.

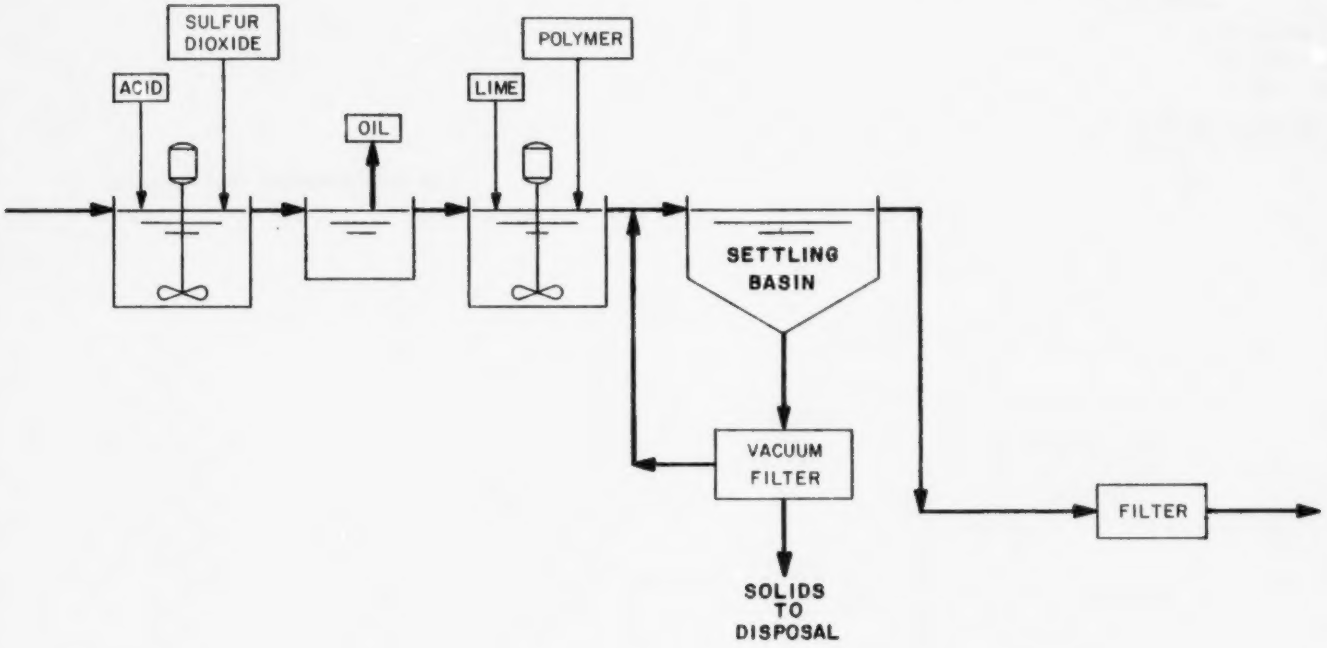
TABLE XIII-4

PRETREATMENT EFFLUENT STANDARDS FOR NEW SOURCES
SCALE REMOVAL SUBCATEGORY - HYDRIDE

		PSNS Alternative 1*		PSNS Alternative 2	
		Concentration Basis (mg/l)	Effluent Standards (kg/kkg)	Concentration Basis (mg/l)	Effluent Standards (kg/kkg)
Discharge Flow (Gal/Ton)		50	-	50	-
Chromium (Total)	Ave.	0.10	0.000021	0.10	0.000021
	Max.	0.30	0.000063	0.30	0.000063
Cyanide (Total)	Ave.	0.25	0.000052	0.25	0.000052
	Max.	0.75	0.00016	0.75	0.00016
Lead (Total)	Ave.	0.10	0.000021	0.10	0.000021
	Max.	0.30	0.000063	0.30	0.000063

---

*: Selected PSNS alternative.



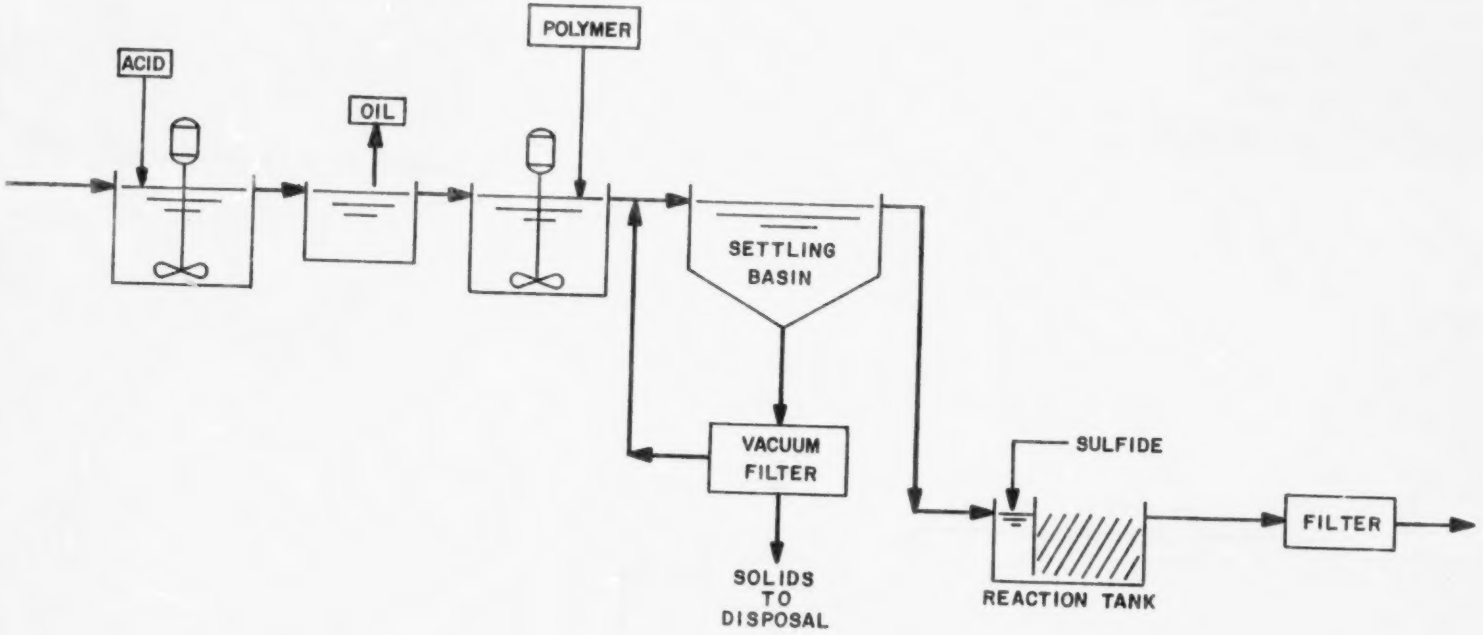
Discharge Flow Allowance: 320 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
PSES MODEL-ALTERNATIVE I

Dwn. 6/17/80

FIGURE XIII-1



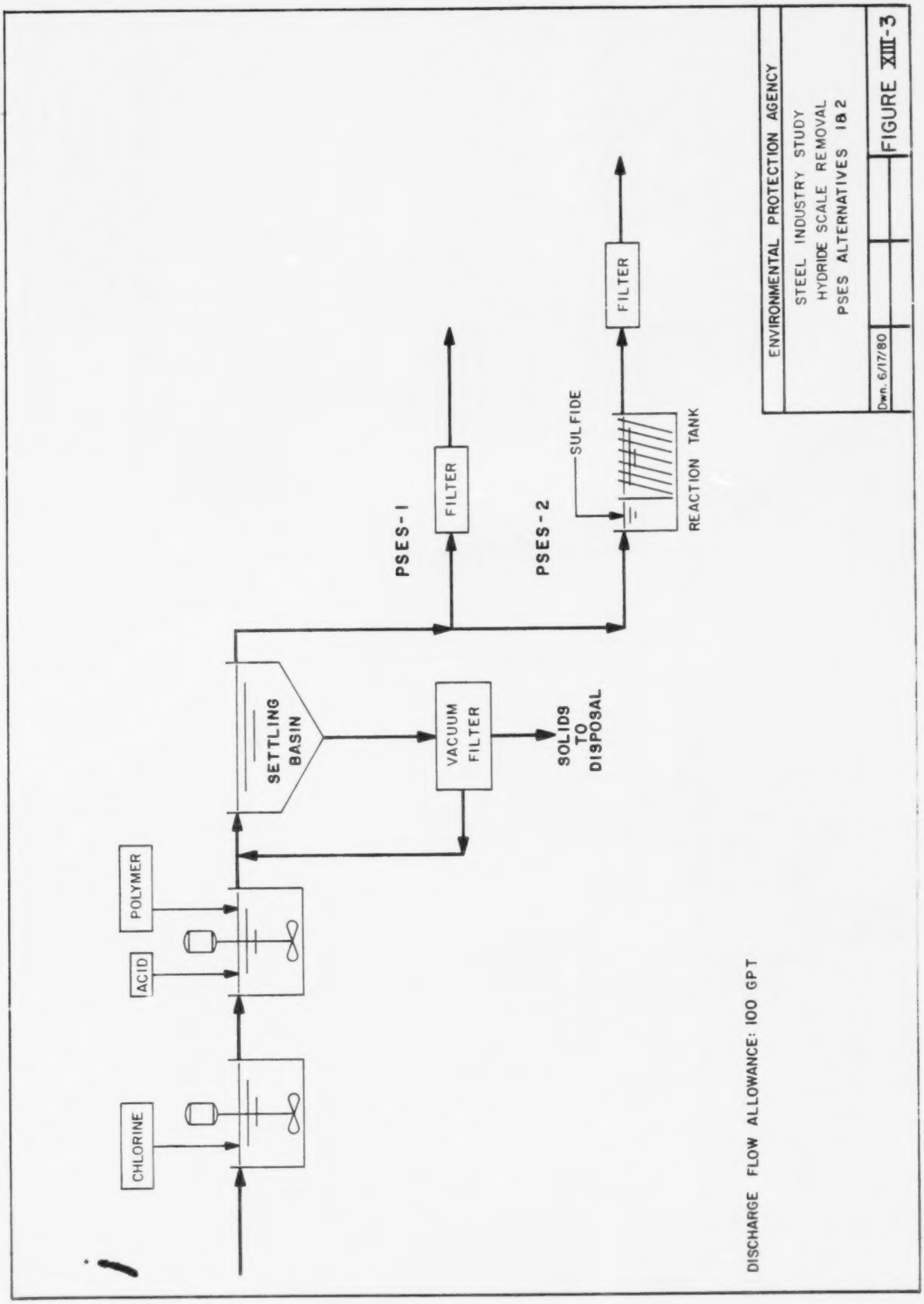
Discharge Flow Allowance: 320 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
PSES MODEL-ALTERNATIVE 2

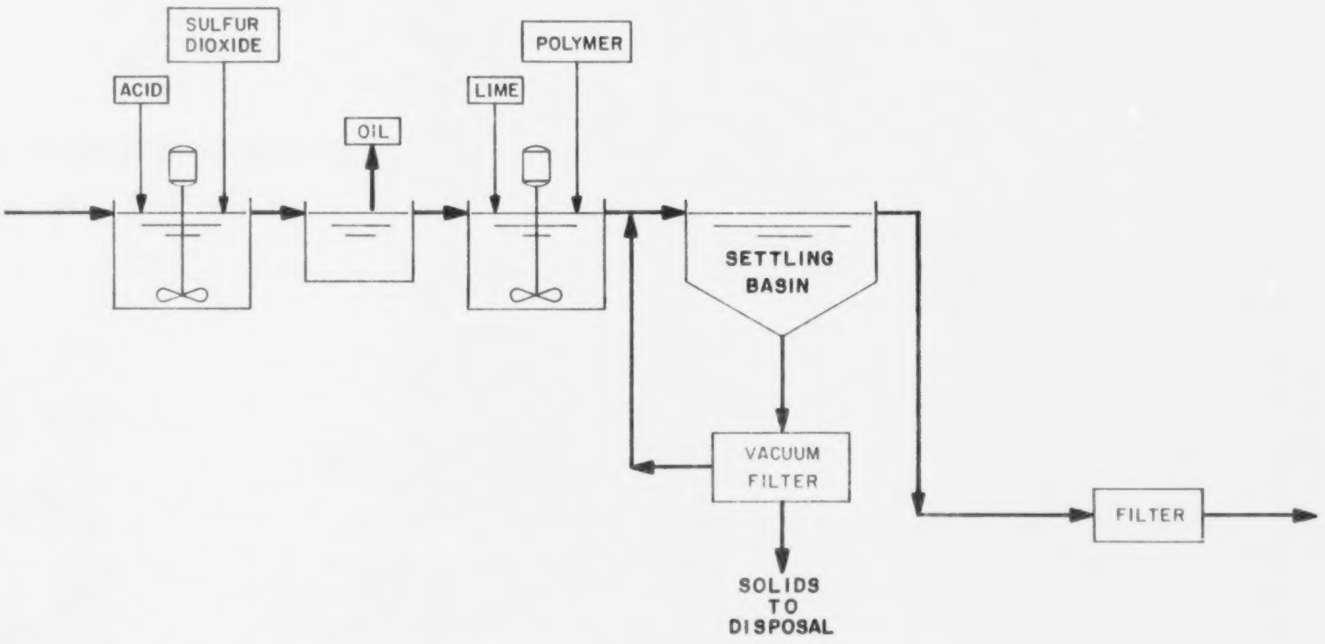
Dwn. 7/17/80

FIGURE XIII-2



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HYDRIDE SCALE REMOVAL
PSES ALTERNATIVES 1&2

FIGURE XIII-3



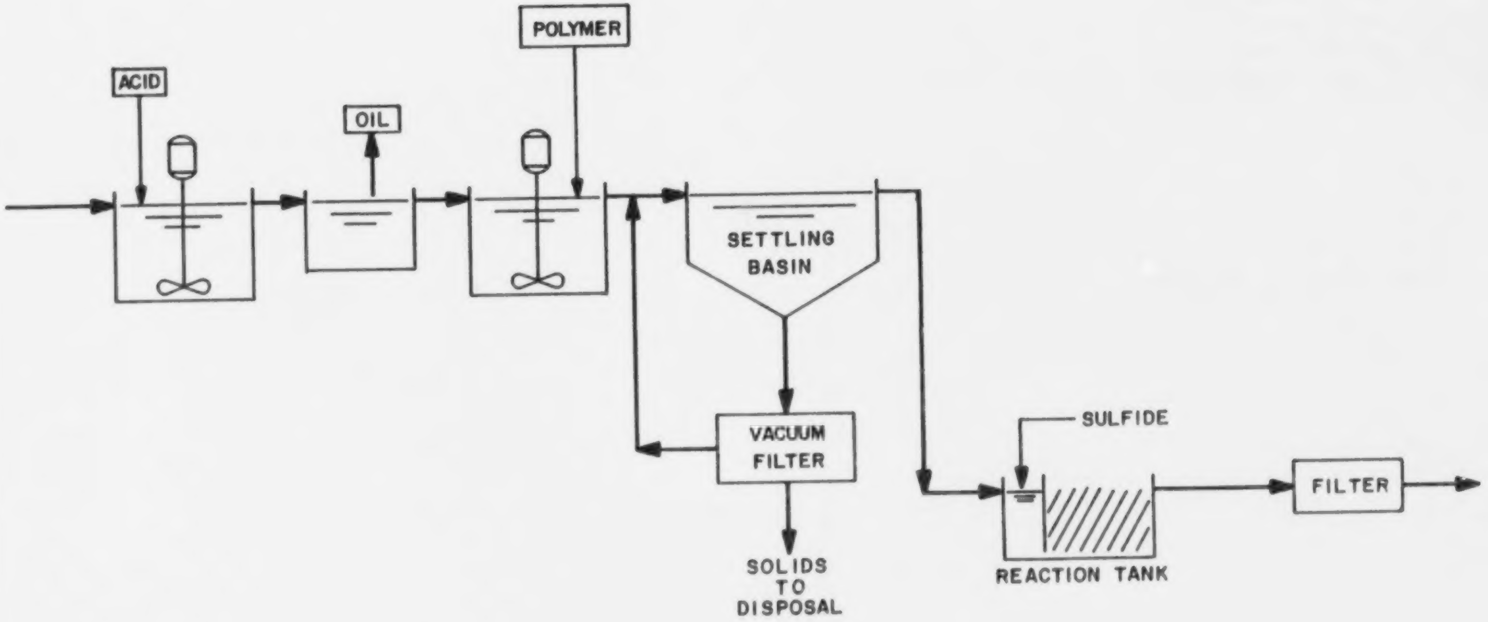
Discharge Flow Allowance: 200 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
PSNS MODEL-ALTERNATIVE I

Dwn. 6/18/80

FIGURE XIII-4



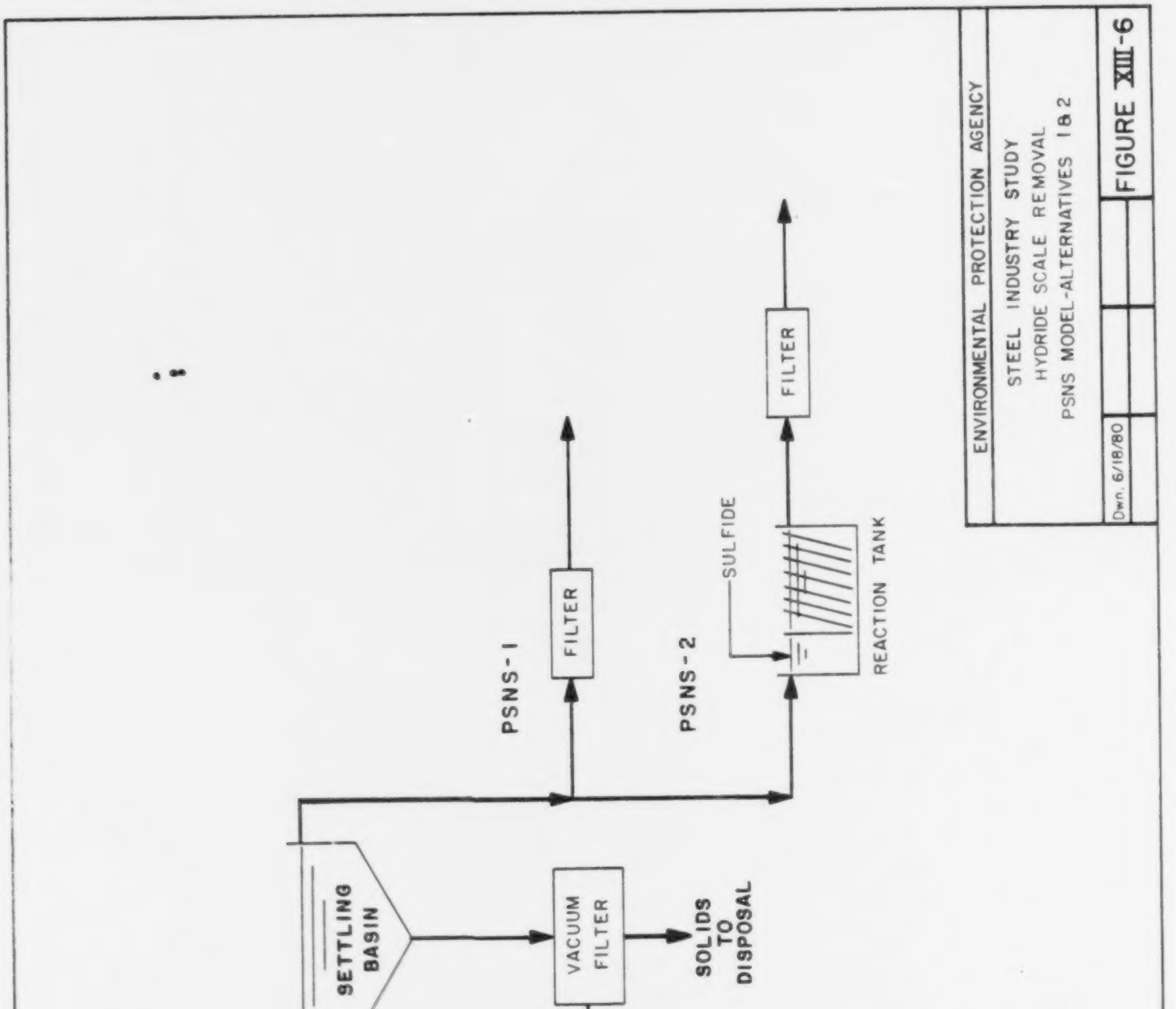
Discharge Flow Allowance: 200 GPT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
KOLENE SCALE REMOVAL
PSNS MODEL-ALTERNATIVE 2

Dwn. 7/17/80

FIGURE XIII-5



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HYDRIDE SCALE REMOVAL
PSNS MODEL-ALTERNATIVES 1&2
Dwn. 6/18/80
FIGURE XIII-6

ACID PICKLING SUBCATEGORY

SECTION I

PREFACE

The USEPA is proposing effluent limitations guidelines and standards for the steel industry. The proposed regulation contains effluent limitations guidelines for best practicable control technology currently available (BPT), best conventional pollutant control technology (BCT), and best available technology economically achievable (BAT) as well as pretreatment standards for new and existing sources (PSNS and PSES) and new source performance standards (NSPS), under Sections 301, 304, 306, 307 and 501 of the Clean Water Act.

This part of the Development Document highlights the technical aspects of EPA's study of the Acid Pickling Subcategory of the Iron and Steel Industry. Volume I of the Development Document discusses issues pertaining to the industry in general, while other volumes relate to the remaining subcategories of the industry.

ACID PICKLING SUBCATEGORY

SECTION II

CONCLUSIONS

This volume highlights the technical aspects of EPA's study of the Acid Pickling Subcategory of the Iron and Steel Manufacturing Category.

Based upon this current study and a review of previous studies, the Agency has reached the following conclusions.

1. The Agency has combined all acid pickling operations into one subcategory. The three subdivisions of the subcategory - sulfuric, hydrochloric, and combination - reflect significant differences in wastewater volume. Further segmentation of these subdivisions reflects differences in production processes.

2. The Agency is proposing BPT limitations for the acid pickling subcategory which are identical to those promulgated in March 1976. However, additional BPT limitations are being proposed for batch sulfuric acid neutralization operations. In the March 1976 regulation, the BPT limitation for all batch sulfuric operations was zero discharge. Reanalysis of the data for this segment indicates that batch neutralization and batch acid recovery operations should be limited separately. The proposed BPT limitations are well demonstrated throughout the industry.

3. The proposed BAT, NSPS, PSES, and PSNS limitations and standards are based upon model plant flow rates (applied and discharge) determined from the expanded data base which the Agency obtained as part of this study. While, in some cases, these model flow rates are different from those used to develop the limitations promulgated in 1976, they are more representative of the industry. Thus, the Agency believes industry-wide costs and effluent limitations based upon these flow data are more accurate and appropriate.

4. Sampling and analysis of acid pickling wastewaters revealed significant concentrations of conventional and toxic metal pollutants. In addition, toxic organic pollutants were found at low levels in some acid pickling wastewaters. The Agency estimates that the following pollution control benefits will result from compliance with the proposed BPT and BAT limitations.

Pollutant	Effluent Discharges (Tons/Year) Raw Waste	Proposed BPT	Proposed BAT
Flow, MGD	172.7	69.2	15.0
TSS	36,211	3,819	551
Oil and Grease	5,003	850	141
Toxic Metals	31,918	86.1	15.5
Toxic Organics	4.6	1.7	0.3
Dissolved Iron	544,989	85.0	18.3
Fluoride	29,345	257	80.8

5. Based upon pollution control facilities in place as of January 1, 1978, the Agency estimates the industry will incur the following costs in complying with the proposed limitations.

Treatment Level	Costs (Millions of July 1, 1978 Dollars)			
	Investment			Total
	Total	In Place	Required	Annual
BPT	309.0	138.5	170.5	67.96
BAT	6.16	-	6.16	8.57
TOTAL	315.16	138.5	176.66	76.53

NOTE: PSES costs are included in those for BPT and BAT.

6. The Agency evaluated the "cost/reasonableness" of controlling the conventional pollutants, TSS, oil and grease, and pH. The BCT model treatment systems, for the hydrochloric acid regeneration and continuous neutralization segments, have control costs less than the costs experienced by publicly owned treatment works (POTWs). Therefore, EPA is proposing BCT limitations for TSS and oil and grease based upon the application of the BCT model treatment systems for these two segments of the acid pickling subcategory. In the sulfuric and combination acid subdivisions and in the batch neutralization segment of the hydrochloric acid subdivision, BCT limitations are being proposed at the BPT level, since the respective BCT model treatment alternatives did not pass the BCT Cost Test.

7. NSPS are proposed for acid pickling operations which are constructed after the proposal of these standards. The proposed standards are based upon the same or similar technologies used for BPT and BAT in all subdivisions except for sulfuric acid pickling. The proposed standard (zero discharge) for these operations is based upon the acid recovery mode of operation.

8. EPA is proposing pretreatment standards for new (PSNS) and existing (PSES) sources which limit the amount of toxic and other pollutants discharged to POTWs. These standards are intended to minimize the impact from pollutants which would interfere with, pass through, or otherwise be incompatible with POTW operations. These proposed standards are based upon the same or similar technologies used for BPT and BAT.

9. With regard to the "remand issues," the Agency concludes that the age of a plant has no significant effect upon the ease or cost of retrofitting pollution control equipment. Neither relaxed limitations for older plants nor retrofit cost allowances are proposed for acid pickling operations. There are no significant adverse air pollution, solid waste disposal, or water consumption impacts associated with the proposed limitations and standards.

10. The proposed effluent limitations and standards are based upon flow (gal/ton) and pollutant concentrations to yield mass limitations in kg/kkg (lb/1000 lb) of steel pickled. The Agency considered using product surface area pickled as a basis for the limitations and standards, but such data are not readily available. Hence, the proposed limitations and standards are based upon production tonnage.

11. The Agency derived the fume scrubber wasteload contributions on a water flow per ton of pickled product basis. Since the scrubbers are open-container air cleaning devices, dependent on the amount of gases treated, this basis may not be the most representative for all pickling operations. However, the Agency believes that the per unit weight of pickled product flow basis is the most readily acceptable and least cumbersome method of flow determination for this waste source.

12. Although the Agency found a significant number of toxic metal pollutants in acid pickling wastewaters, it is proposing BAT, NSPS, PSES, and PSNS limitations and standards for three toxic metals. These pollutants serve as "indicator" pollutants for those toxic metals which are not directly limited. Chromium, lead, and zinc are used as indicator pollutants for the sulfuric and hydrochloric acid subdivisions. Chromium, copper, and nickel have been selected for the combination acid subdivision.

13. The Agency used the best demonstrated flows to develop NSPS and PSNS for the combination acid pickling subdivision. However, the Agency relied upon average of the best flows in the BAT, BCT, and PSES model treatment systems for combination acid pickling. The average of the best flows were also used in the BAT, BCT, NSPS, PSES, and PSNS model treatment systems for sulfuric acid pickling and hydrochloric acid pickling. The Agency is soliciting comments on whether the best demonstrated flows should be used to develop BAT, BCT, NSPS, PSES, and PSNS effluent limitations and standards for all pickling subdivisions.

14. Table II-1 presents the treatment model flow and effluent quality data used to develop the proposed BPT effluent limitations for the acid pickling subcategory, and Table II-2 presents these proposed limitations. Table II-3 presents the treatment model flow and effluent quality data used to develop the proposed BAT and BCT effluent limitations and the proposed NSPS, PSES, and PSNS for the acid pickling subcategory. Table II-4 presents these proposed limitations and standards.

TABLE II-1

BPT TREATMENT MODEL FLOWS AND EFFLUENT QUALITY
ACID PICKLING SUBCATEGORY

Subdivision	Pollutant	Monthly Average Concentrations[1]					
		Batch Acid Recovery	Batch Neutralization	Continuous Acid Recovery	Continuous Neutralization With Spent Pickle Liquor	Continuous Neutralization Without Spent Pickle Liquor	
Sulfuric Acid	Flow, gal/ton	0	360	0	250	225	
	TSS	-	50	-	50	50	
	Oil & Grease[2]	-	10	-	10	10	
	Iron, Dissolved	-	1.0	-	1.0	1.0	
	pH, Units	-	6.0 to 9.0	-	6.0 to 9.0	6.0 to 9.0	
		Batch Neutralization With Scrubber	Batch Neutralization Without Scrubber	Continuous Neutralization With Scrubber	Continuous Neutralization Without Scrubber	Continuous Acid Regeneration With Scrubber	Continuous Acid Regeneration Without Scrubber
Hydrochloric Acid	Flow, gal/ton	280	230	280	230	450	400
	TSS	50	50	50	50	50	50
	Oil & Grease[2]	10	10	10	10	10	10
	Iron, Dissolved	1.0	1.0	1.0	1.0	1.0	1.0
	pH, Units	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0
		Batch-Other	Batch-Pipe & Tube	Continuous			
Combination Acid	Flow, gal/ton	200	700	1000			
	TSS	25	25	25			
	Oil & Grease[2]	10	10	10			
	119 Chromium, Total	0.5	0.5	0.5			
	Iron, Dissolved	1.0	1.0	1.0			
	124 Nickel, Total	0.25	0.25	0.25			
	Fluoride[3]	15	15	15			
	pH, Units	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0			

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(1) Daily maximum concentrations are three times the monthly average concentrations. Also, concentrations are expressed as mg/l unless otherwise noted.

(2) Oil and Grease is limited only when pickling wastewater is treated in combination with cold rolling wastewaters.

(3) Fluoride is limited only at those combination acid pickling operations that use hydrofluoric acid.

TABLE II-2

PROPOSED BPT EFFLUENT LIMITATIONS-ACID PICKLING SUBCATEGORY

Effluent Limitations (kg/kkg of Product)[1]

Subdivision	Pollutant	Batch and Continuous Acid Recovery	Batch Neutralization	Continuous Neutralization with Spent Pickle Liquor	Continuous Neutralization without Spent Pickle Liquor
Sulfuric Acid	TSS[2]	0	0.0751	0.0521	0.0469
	O&G	0	0.0150	0.0104	0.00938
	Iron, Dissolved	0	0.00150	0.00104	0.000938
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0

Subdivision	Pollutant	Batch Neutralization with Scrubber	Batch Neutralization without Scrubber	Continuous Neutralization with Scrubber	Continuous Neutralization without Scrubber	Continuous Acid Regeneration with Scrubber	Continuous Acid Regeneration without Scrubber
Hydrochloric Acid	TSS[2]	0.0584	0.0480	0.0584	0.0480	0.0938	0.0834
	O&G	0.0117	0.00960	0.0117	0.00960	0.0187	0.0166
	Iron, Dissolved	0.00117	0.000960	0.00117	0.000960	0.00187	0.00166
	pH, Units	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0

Subdivision	Pollutant	Batch-Other	Batch Pipe & Tube	Continuous
Combination Acid	TSS[2]	0.0209	0.0730	0.104
	O&G	0.00834	0.0292	0.0417
	119 Chromium, Total	0.000417	0.00146	0.00209
	Iron, Dissolved	0.000834	0.00292	0.00417
	124 Nickel, Total	0.000209	0.000730	0.00104
	Fluoride[3]	0.0125	0.0438	0.0626
	pH, Units	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0

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(1) Daily maximum limitations are three times the monthly average limitations.
(2) Oil & Grease is limited only when pickling wastewater is treated in combination with cold rolling wastewater.
(3) Fluoride is limited only at those combination acid pickling operations that use hydrofluoric acid.

TABLE II-3

TREATMENT MODEL FLOWS AND EFFLUENT QUALITY-ACID PICKLING SUBCATEGORY

Subdivision	Pollutants	Monthly Average Concentrations$^{(1)}$				
		BAT	BCT	NSPS	PSES	PSNS
Sulfuric Acid						
a. Batch & Continuous Acid Recovery	Flow, gal/ton	0	0	0	0	0
b. Batch Neutralization	Flow, gal/ton	70	360	(2)	70	(2)
	TSS	-	50		-	
	O&G$^{(3)}$	-	10		-	
	119 Chromium, Total	0.10	-		0.10	
	122 Lead	0.10	-		0.10	
	128 Zinc, Total	0.10	-		0.10	
	pH, Units	-	6.0 to 9.0		-	
c. Continuous Neutralization	Flow, gal/ton	55	250	(2)	55	(2)
	TSS	-	50		-	
	O&G$^{(3)}$	-	10		-	
	119 Chromium, Total	0.10	-		0.10	
	122 Lead	0.10	-		0.10	
	128 Zinc, Total	0.10	-		0.10	
	pH, Units	-	6.0 to 9.0		-	
Hydrochloric Acid						
a. Continuous Acid Regeneration	Flow, gal/ton	70	70	70	70	70
	TSS	-	15	30	-	-
	O&G$^{(3)}$	-	10*	10	-	-
	119 Chromium, Total	0.10	-	0.10	0.10	0.10
	122 Lead	0.10	-	0.10	0.10	0.10
	128 Zinc, Total	0.10	-	0.10	0.10	0.10
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-

TABLE II-3
TREATMENT MODEL FLOWS AND EFFLUENT
QUALITY-ACID PICKLING SUBCATEGORY
PAGE 2

Subdivision	Pollutants	Monthly Average Concentrations(1)				
		BAT	BCT	NSPS	PSES	PSNS
b. Batch Neutralization	Flow, gal/ton	90	560	90	90	90
	TSS	-	50	30	-	-
	O&G(3)	-	10	10	-	-
	119 Chromium, Total	0.10	-	0.10	0.10	0.10
	122 Lead	0.10	-	0.10	0.10	0.10
	128 Zinc, Total	0.10	-	0.10	0.10	0.10
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
c. Continuous Neutralization	Flow, gal/ton	55	55	55	55	55
	TSS	-	15	30	-	-
	O&G(3)	-	10*	10	-	-
	119 Chromium, Total	0.10	-	0.10	0.10	0.10
	122 Lead	0.10	-	0.10	0.10	0.10
	128 Zinc, Total	0.10	-	0.10	0.10	0.10
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
Combination Acid						
a. Batch	Flow, gal/ton	105	(4)	45	105	45
	TSS	-	25	30	-	-
	O&G(3)	-	10	10	-	-
	119 Chromium, Total	0.10	-	0.10	0.10	0.10
	120 Copper, Total	0.10	-	0.10	0.10	0.10
	124 Nickel, Total	0.20	-	0.20	0.20	0.20
	Fluoride	15	-	15	-	-
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
b. Continuous	Flow, gal/ton	335	1000	90	335	90
	TSS	-	25	30	-	-
	O&G(3)	-	10	10	-	-
	119 Chromium, Total	0.10	-	0.10	0.10	0.10
	120 Copper, Total	0.10	-	0.10	0.10	0.10
	124 Nickel, Total	0.20	-	0.20	0.20	0.20
	Fluoride	15	-	15	-	-
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-

TABLE II-3
TREATMENT MODEL FLOWS AND EFFLUENT
QUALITY-ACID PICKLING SUBCATEGORY
PAGE 3

(1) **Daily maximum** concentrations are based upon the monthly average concentrations multiplied by the following factors:

Pollutants	Factor
TSS (BCT for HCl continuous acid regeneration and HCl continuous neutralization)	2.67
O&G and TSS (H_2SO_4-batch & continuous neutralization, HCl batch neutralization, and combination batch and continuous neutralization)	3.00
O&G and TSS (NSPS)	2.00
Chromium, Lead and Zinc	3.00
Nickel	2.25
Fluoride	3.00

Also all concentrations are expressed as mg/l unless otherwise noted.

(2) No NSPS or PSNS are being proposed for this segment. All new source sulfuric operations will use acid recovery systems.

(3) Oil & Grease is limited only when pickling wastewater is treated in combination with cold rolling wastewater.

(4) Flow for batch-other operations equals 200 gal/ton. Flow for batch-pipe and tube operations equals 700 gal/ton.

* Daily maximum concentration only, as shown.

TABLE II-4

PROPOSED EFFLUENT LIMITATIONS AND STANDARDS-ACID PICKLING SUBCATEGORY

Subdivision	Pollutants	Effluent Limitations and Standards (kg/kkg of Product)(1)				
		BAT	BCT	NSPS	PSES	PSNS
1. Sulfuric Acid						
a. Batch & Continuous Acid Recovery	NA	ZERO DISCHARGE OF PROCESS GENERATED POLLUTANTS				
b. Batch-Neutralization	TSS	-	7506	(2)	-	(2)
	O&G(3)	-	1501		-	
	119 Chromium, Total	2.92	-		2.92	
	122 Lead	2.92	-		2.92	
	128 Zinc, Total	2.92	-		2.92	
	pH, Units	-	6.0 to 9.0		-	
c. Continuous Neutralization	TSS	-	5210	(2)	-	(2)
	O&G(3)	-	1040		-	
	119 Chromium, Total	2.30	-		2.30	
	122 Lead	2.30	-		2.30	
	128 Zinc, Total	2.30	-		2.30	
	pH, Units	-	6.0 to 9.0		-	
2. Hydrochloric Acid						
a. Continuous Acid Regeneration	TSS	-	438	876	-	-
	O&G(3)	-	292*	292	-	-
	119 Chromium, Total	2.92	-	2.92	2.92	2.92
	122 Lead	2.92	-	2.92	2.92	2.92
	128 Zinc, Total	2.92	-	2.92	2.92	2.92
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
b. Batch-Neutralization	TSS	-	5840	1130	-	-
	O&G(3)	-	1170	375	-	-
	119 Chromium, Total	3.75	-	3.75	3.75	3.75
	122 Lead	3.75	-	3.75	3.75	3.75
	128 Zinc, Total	3.75	-	3.75	3.75	3.75
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-

TABLE II-4
PROPOSED EFFLUENT LIMITATIONS AND
STANDARDS-ACID PICKLING SUBCATEGORY
PAGE 2

Subdivision	Pollutants	Effluent Limitations and Standards (kg/kkg of Product)(1)				
		BAT	BCT	NSPS	PSES	PSNS
c. Continuous Neutralization	TSS	-	344	688	-	-
	O&G(3)	-	229*	229	-	-
	119 Chromium, Total	2.29	-	2.29	2.29	2.29
	122 Lead	2.29	-	2.29	2.29	2.29
	128 Zinc, Total	2.29	-	2.29	2.29	2.29
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
3. Combination Acid						
a. Batch-Neutralization	TSS	-	2090(7300)(4)	563	-	-
	O&G(3)	-	834(2920)(4)	188	-	-
	119 Chromium, Total	4.38	-	1.88	4.38	1.88
	120 Copper, Total	4.38	-	1.88	4.38	1.88
	124 Nickel, Total	8.76	-	3.75	8.76	3.75
	Fluoride	657	-	281	-	-
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-
b. Continuous Neutralization	TSS	-	10400	1130	-	-
	O&G(3)	-	4170	375	-	-
	119 Chromium, Total	14.4	-	3.75	14.4	3.75
	120 Copper, Total	14.4	-	3.75	14.4	3.75
	124 Nickel, Total	28.8	-	7.51	28.8	7.51
	Fluoride	2160	-	563	-	-
	pH, Units	-	6.0 to 9.0	6.0 to 9.0	-	-

TABLE II-4
PROPOSED EFFLUENT LIMITATIONS AND
STANDARDS-ACID PICKLING SUBCATEGORY
PAGE 3

(1) The proposed limitations and standards have been multiplied by 10^5 to obtain the values presented in this table. Also, daily maximum limitations and standards are based upon the monthly average values multiplied by the following factors:

Pollutants	Factor
TSS (BCT for HCl cont. acid regeneration and HCl continuous neutralization.)	2.67
O&G and TSS (H_2SO_4-batch and continuous neutralization, HCl batch neutralization, and combination batch and continuous neutralization)	3.00
O&G and TSS (NSPS)	2.00
Chromium, Lead and Zinc	3.00
Nickel	2.25
Fluoride	3.00

(2) No NSPS or PSNS are being proposed for this segment. All new source sulfuric operations will use acid recovery systems.

(3) Oil and grease is limited only when pickling wastewater is treated in combination with cold rolling wastewater.

(4) Values listed are for batch-other operations. Values listed in parentheses are the BCT limits for batch-pipe and tube operations.

*: Daily maximum limitation only, as shown.

ACID PICKLING SUBCATEGORY

SECTION III

INTRODUCTION

General Discussion

Acid pickling is the steel finishing process in which steel products are immersed in heated acid solutions to remove surface scale. The Agency has divided the acid pickling subcategory into three subdivisions which are based upon the type of pickling acid solutions used in the process.

1. Sulfuric Acid Pickling
2. Hydrochloric Acid Pickling
3. Combination Acid Pickling

Wastewaters are commonly generated by three sources in the pickling operation. The largest source is the rinsewater used to clean the acid solution from the product after it has been immersed in the pickling solution. The second source is the spent pickling acid (liquor) which is used to treat the steel product. The spent pickle liquor is a small volume waste, containing high concentrations of iron and toxic metal pollutants, which is discharged after it becomes contaminated by use. Wastewater from wet fume hood scrubbers is the third source. However, not all plants have wet fume hood scrubbers. For hydrochloric acid regeneration plants, absorber vent scrubber wastewater is a source of contamination similar in nature to that of pickle rinsewaters.

Those wastewaters require treatment prior to discharge to a receiving stream or to a POTW. This report discusses the wastewater treatment systems presently used at pickling operations and the proposed effluent limitations and standards for those discharges.

Data Base

1. Sulfuric Acid Pickling

   The effluent limitations originally promulgated in 1976 for sulfuric acid pickling operations were primarily based upon data obtained through field sampling at seven continuous and eight batch sulfuric acid pickling operations. This present study included field sampling at three continuous and seven batch sulfuric acid operations, as well as an overall review of the wastewater treatment systems used at all sulfuric acid pickling operations surveyed by the DCPs. The Agency received responses to the DCPs for plants which comprise about 85% of the annual capacity. A summary of all sulfuric pickling operations responding to the DCPs is presented in Table III-1.

The Agency, after reviewing and analyzing the DCP responses made by the industry, forwarded detailed DCPs (D-DCPs) to selected pickling operations. Those D-DCPs requested cost and monitoring data from one continuous and 17 batch operations. The operations included three batch plants which were sampled during the initial survey.

The expanded data base is presented in Tables III-4 and III-5. The field sampling covered 13% of the continuous sulfuric acid pickling plants in operation, which have 21% of the annual capacity of the industry. The Agency also sampled 9% of the batch pickling operations, which have 13% of the annual capacity of the industry.

2. Hydrochloric Acid Pickling

The effluent limitations originally promulgated in 1976 for hydrochloric acid pickling operations were primarily based upon data obtained through field sampling at fourteen operations. During this study, the Agency conducted field sampling at two of the same plants and at seven additional operations. In addition, the Agency reviewed wastewater treatment systems used at all plants surveyed by DCPs. It also sent D-DCPs to thirteen plants (two of which had been previously sampled) requesting cost and analytical information comprising 13% of the industry capacity. The expanded data base is presented in Table III-6. The field sampling covered about 21% of the annual pickling capacity. Table III-2 provides a general summary of available data on hydrochloric acid pickling operations.

3. Combination Acid Pickling

The originally promulgated limitations for the combination acid pickling subcategory were primarily based upon data obtained through field sampling at eight operations. During this current study, the Agency sampled six additional plants to increase the existing data base. The Agency conducted sampling at one plant twice, and the data collected during each visit are presented in this report. However, only the data gathered during the later visit have been used in establishing the proposed limitations. The updated data base for the combination acid pickling subdivision is shown in Tables III-7 and III-8.

The Agency received responses to the DCPs from approximately 85% of the active combination acid pickling operations. Sixty-six batch and sixty-three continuous operations provided information in response to the DCPs. The data received from these plants are summarized in Table III-3.

The Agency sent D-DCPs to selected combination acid pickling operations to gather information regarding plant operations and long-term effluent quality and cost information for wastewater treatment systems. The Agency received responses from five combination acid pickling operations.

Table III-9 summarizes the pickling operations sampled for this study and describes those operations.

Description of Pickling Operations

During the forming and finishing operations, the steel product is exposed to the atmosphere, which causes oxide scale to form on its surface. This scale must be removed prior to further processing, as proper surface preparation is the most important requirement for the satisfactory application of protective coatings to steel, as well as for cold rolling. Without a properly cleaned surface, even the coating will fail to adhere. A variety of cleaning methods are used to insure adequate surface preparation for subsequent coating. In addition, the steel surface must also be cleaned (by pickling) at various stages during the production process to insure that oxides which form on the surface are not worked into the finished product causing marring, staining, or other surface imperfections.

The traditional method of removing scale is called "acid pickling," or simply "pickling." Pickling is the process during which surface oxides (scale) are removed chemically from the surface of the steel product by immersing it in a heated acid solution. While pickling is only one of several methods for removing undesirable oxides from the steel surface, it is the most widely used in the steel industry because of its comparatively low operating cost and ease of operation. Carbon steel pickling is almost universally accomplished by using either hydrochloric acid or sulfuric acid solutions. Pickling operations for specialty steels include more than one acid. Typically, nitric and hydrofluoric acids are used together. The acid combinations vary with the type of material to be pickled. The bath temperature, use of inhibitors, and agitation also vary depending upon the material to be pickled. Pickling is accomplished in either batch or continuous operations.

Temperature, agitation, and acid and iron concentration are important operating factors in the pickling process.

Temperature

The temperature of the acid bath in which the product is pickled is critical because it dramatically affects the rate of reaction. However, the method of heating the acid batch is also important. If the bath is heated by injecting steam directly into it, it becomes diluted as the steam condenses into water. To avoid dilution, internal or external heat exchangers are usually employed. These devices transfer heat from steam indirectly to the acid bath, thus avoiding dilution of the bath and reducing the volume of spent acid requiring treatment or disposal.

Agitation

Agitation is probably the most ignored aid to good pickling. The speed of the pickling process can be increased significantly by properly agitating the acid bath, or moving the steel during the pickling operation. The latter may be accomplished by raising and lowering the bundle of steel in the bath, or by having a conveyor system keep it moving while passing through the bath. Agitating the acid bath is a more complex operation.

One method of agitation is a custom designed, air-operated, mechanical agitation system. An added benefit of this system is that the evaporation (caused by air agitation) concentrates, rather than dilutes, the acid bath. The induced evaporation requires that pickling acids be added to mantain optimum tank level. The acid mists caused by the agitation system can be collected in a suitable exhaust system and returned to the pickle tank for reuse.

Acid and Iron Concentration

The concentrations of acid and ferrous salts in the bath are related directly to the rate of reaction and, subsequently, to the rate of pickling. Most pickling operations do not have facilities to maintain consistent acid strengths. As products are processed over a period of time, the free acid content of the bath progressively diminishes, which in turn results in increasingly longer pickling times. As the strength of the acid drops below a certain level, the spent pickle liquor is dumped. The tanks are replenished with fresh acid and the cycle begins anew. On the other hand, technology is available to make such operations more efficient. For example, acid recovery may be practiced at sulfuric acid pickle lines. In such an operation, the acid solution is continually bled from the bath as fresh acid is added to maintain the bath at a constant strength. The waste acid is then regenerated and fed back to the bath. The by-product from the acid recovery process is ferrous sulfate crystals. These crystals can be sold to pigment manufacturers. They can also be used as fertilizer supplements or coagulants for water and wastewater treatment.

Type of Pickling

A. Batch Pickling

Large, open tanks which vary widely in size, are used for batch pickling operations. The tanks are used principally for rods, bars, billets, plate, sheet, strip, wire, and tubing. The tanks are generally rubber lined and brick sheathed and hold large volumes of heated acid solution. After continual use, the free acid content decreases and iron builds up in the acid solution due to the scale removed. When the pickling process is impaired, the acid solution is considered spent and is dumped as a batch. Flow schematics for carbon and specialty batch pickling operations are shown in Figures III-1 and III-2.

B. Continuous Pickling

Continuous pickling operations principally use horizontal pickling tanks. In a few cases, however, vertical spray tanks are employed. A fresh acid solution is added to the last tank section and cascades through a series of tanks to an overflow located in the first tank. The acid solution flows in the direction opposite to that in which the steel product travels.

There are usually at least two acid tanks used in continuous pickling, with each one divided into four or five compartments. The fresh acid solution is added to the last tank section and cascades through the tank to an overflow located in the first section. Acid flow is opposite to the direction of product travel. Flow schematics for carbon and specialty continuous acid pickling operations are shown in Figures III-3 and III-4.

Description of Wastewater Sources

There are three process steps which generate most of the wastewaters associated with the pickling process.

1. Pickling - immersion in hot acid solution. The waste is the spent solution.

2. Rinsing - removal of pickle liquor from the surface of the product, using water. The contaminated rinsewater is discharged.

3. Fume Scrubbing - control of acid vapors and mists by scrubbing the air and other vapors removed from the immediate area of the pickling operations by means of an exhaust system. The contaminated scrubber water is discharged.

Pickling

As discussed previously, the strength of the pickle liquor progressively diminishes as more and more products are pickled. When the strength drops below a certain level, the spent pickle liquor is discarded. Contract hauling is a common disposal method practiced at many plants. Alternatively, the spent pickle liquor may be treated along with other wastewaters from the pickling operation, or it may be recovered (sulfuric and hydrochloric acid) for reuse in the pickling operation. Spent sulfuric or hydrochloric acid may also be used as a coagulant in wastewater treatment.

Rinsing

The rinse operation may vary from a one-step dunk or spraying to more sophisticated multi-stage rinsing with still or running tanks, cascade rinsing, and countercurrent sprays. The primary purpose of the rinse is to remove contaminants from the steel product prior to the next step in the finishing process. In a single step rinsing operation, the tanks may be replenished and dumped on a periodic basis or fresh water may be continually added at the end of the tank while wastewater discharges at the opposite end. Where rinsing is performed in a series of tanks, the first rinse removes the bulk of the contaminants from the product, which results in a highly contaminated waste stream. The subsequent rinse tanks are progressively cleaner. The product emerges from the final tank free of contaminants. Each tank may discharge separately. However where a series of tanks are installed, the more common practice would be to cascade the rinsewaters from the final to the first tank. Fresh make-up water is added to the final tank, which in turn overflows to the previous tank. The rinsewater continues in this fashion to the first tank, from which discharge occurs. The volume of rinsewater from cascade rinse systems is considerably less than the volume from conventional single tank rinsing.

Most continuous strip pickling operations employ the traditional approach to rinsing: flooding the strip with hundreds of gallons of water per minute to wash away the few gallons of acid that are dragged out of the pickling tanks. In the past, this was a practical approach to the problem because it effectively cleaned the strip and diluted the acid content of the rinsewater to a low concentration. The rinse water was then usually discharged. An alternative to the traditional method is the cascade rinse system, which is described above. The dilution rate, from one tank section to the next, follows a geometric progression, so that the number of stages determines how much clean water must be fed into the system to achieve a given degree of rinsing. For instance, a typical, large, high-speed pickle line with a five-stage system could operate with about 20 gpm makeup. The treatment of rinse waters at such low rates of flow becomes much easier. The rinsewaters can be further concentrated and piped to the waste pickle acid recovery or regeneration system, or they may be used as makeup for the solution in the pickling tanks. Even if they are to be treated, the treatment facilities may be sized to economically handle these wastes, since the volume is much less than that for a once-through rinse system.

Multi-stage spray rinsing systems can easily be incorporated into new continuous strip pickling lines, and they can be installed in existing lines in place of the present rinsing sections, with a minimum of inconvenience or lost time. These systems can, and have been, retrofitted to existing pickling operations.

Fume Scrubbing

The generation of acid fumes is prevalent in the pickling process, and these fumes must be removed in order to provide a safe working environment. The fumes from many existing exhaust systems are discharged to the atmosphere, causing air pollution. Either washing or filtration may be used to remove the acid from the fumes.

Wet scrubbing systems use water to trap and flush away the acid droplets in the fumes. This practice, however, merely trades air pollution for water pollution because the acid has contaminated the scrubber water and will require the same level of treatment as rinsewaters. Accordingly, some operations use the internal recycle of wet fume scrubber waters to minimize loads from this source. In addition, the fume scrubber blowdown may be used as makeup of the cold rinse sections.

Acid mist filters are specially designed synthetic fibers in a filter box which is installed in the discharge end of the exhaust system. This unit filters the acid droplets from the fumes and returns them to the pickling tanks. The water vapor in the fumes is allowed to pass through to the atmosphere. The acid mist filter controls air pollution and simultaneously recovers acid for reuse in the pickle tank with no discharge of wastewaters.

Acid Recovery and Acid Regeneration

Acid recovery and regeneration are used for sulfuric acid and hydrochloric acid, respectively. Refer to Section VII for detailed discussions of these processes. Figures III-5 through III-9 in this section illustrate some of the basic processes available at this time. Although the Agency is unaware of any installation within the United States, it should be noted that technology for the recovery of nitric and hydrofluoric acids has apparently been developed. It has been reported that such a system is successfully operating in the People's Republic of China.

Pickling of Different Types of Steel In Combination Acid Pickling Operations

A. Specialty Steel Pickling

Depending upon the type of steel being processed and the surface quality desired, different acids and acid combinations are used in the pickling process. Most of the operations which employ combination acid pickling are specialty steel lines. In fact, 80% of the lines using combination acid pickling process pickle specialty steel products.

Sulfuric, hydrochloric, nitric, and hydrofluoric acids are used in various combinations to pickle the specialty steels. At least two types of acids are used in the combination acid pickling process. Most operations use either sulfuric or hydrochloric acid at the head of the pickle line to soften and loosen the scale and then use either nitric, hydrofluoric, or a mixture of the two acids to remove the scale loosened by the first acid solution. The acid in the first batch is kept at a concentration of about 10%, if sulfuric acid is used, and 15%, if hydrochloric acid is used. In addition, the acid bath is heated to approximately 70°C (160°F) to increase the action of the pickling solution. The acids in the second tank are usually kept at lower concentrations (i.e., 4% HF, 10% HNO_3), but at the same temperature as the first bath.

B. Carbon Steel Pickling

Several carbon steel operations use a combination acid process; usually phosphoric acid in combination with either hydrochloric or sulfuric acid. One operation uses nitric acid in combination with hydrochloric acid to process wire and rods.

Even though different acid combinations are used to pickle carbon steel, the Agency found that both the average flow rates and wastewater characteristics are similar enough to those for specialty steel operations to allow the development of one set of proposed limitations. Certain allowances are provided in the proposed limitations to cover the more significant variations between the two types of pickling operations.

TABLE III-1

SULFURIC ACID PICKLING SUMMARY TABLE

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton)			Discharge Flow (Gallons/ton)			Treatment Components	Dis-charge Mode
						Rinses	Scrubber	Conc.	Rinses	Scrubber	Conc.		
0020B	01	Sheet,Specialty	Cont.	801	1954	539	90	6.4	539	90	6.4(1)	VF,CR,NL,FLP,CL, CNT,OT	Direct
0048B	01(a)	Bar,Wire,Rod	Batch	243	1944	15	None	5.5	15.5(1)	None	5.5(1)	OT, None	Hauled
0048C	01(a)	Bar,Wire	Batch	180	1940	58.3	None	20.0	58.3	None	20.0(1)	NL,SL,OT	Direct
0048D	01(a)	Bar,Wire	Batch	90	1909	27.0	None	27.0	27.0	None	27.0	NL,VF,SL,CNT,OT	POTW
	02(a)	Bar,Wire	Batch	18.6	1900	10.4	None	10.4	10.4	None	10.4	NL,VF,CNT,OT	POTW
0048F	01(a)	Bar,Wire,Rod	Batch	117	1944	37	None	13	37	None	13	VF,NL,SL,OT	POTW
0060C	01(a)	Bar,Bloom,Pipe	Batch	63	1956	Unk	None	8	Unk	None	8(1)	FLP,SSP,SS,CNT,OT	Direct
0060D	01	Strip,Specialty	Cont.	960	1957	Unk	Unk	Unk	Unk	Unk	Unk		Direct
	02	Strip,Specialty	Cont.	120	1952	Unk	Unk	5.0	Unk	Unk	5.0	NL,SL,CNT,AE	Direct
	03	Strip,Specialty	Cont.	114	1959	Unk	Unk	Unk	Unk	Unk	Unk	RT	Direct
0060G	*	*	*	*	*	*	*	*	*	*	*	*	*
0060M	01(a)	Rod,Wire	Batch	816	1970	17.3	None	2.2	8.1	None	2.2(1)	FDSP,NL,DW,RT	POTW
0060S	*	*	*	*	*	*	*	*	*	*	*	*	*
0068	01(a)	Flat Bars,Strip	Batch	93.6	1934	769	None	70	769	None	70	OT, None	POTW
0088A	01(a)	Bars	Batch	744	1942	<1	None	8.1	<1(1)	None	8.1(1)	OT, None	Hauled
	02	Tubes,Specialty	Batch	243.9	1936	49.2	None	22.6	0	None	22.6(1)	CR,NL,FLP,CL,	Direct (Unk)
	03(a)	Tubes	Batch	519	Unk	[326]	None	[14.6]	[326]	None	[14.6](1)	T,VF,SS,E,	Direct (Unk)
	04(a)	Tubes,Specialty	Batch	246	1946	117	None	16.3	117	None	16.3(1)	CNT,(Line No.	Direct
	05	Tubes,Specialty	Batch	87	1941	132	None	42.1	132	None	42.1(1)	02 & 03 Recycle) (04 & 05 OT)	Direct
0088B	*	*	*	*	*	*	*	*	*	*	*	*	*
0088D	01(a)	Bars	Batch	717	1952	4.7	None	14.2	2.1	None	14.2(1)	NL,FLP,CL,SS,VF, CNT,OT	Direct
	02	Tubes,Specialty	Batch	51.9	1969	277.5	None	Unk	277.5	None	Unk(1)	E,NC,FDSP,OT	Direct
0112	01	Billets,Specialty	Batch	507	1922	9.7	None	11.9	9.7	None	11.9	NL,OT	Direct
	02	Flats,Bars, Specialty	Batch	53.1	1928	231	None	22.5	231	None	22.5		Direct
0112A	01(a)	Pipes	Batch	237	1929	Unk	None	Unk	Unk	None	Unk	SS,SCR,NL	Direct
	02(a)	Plate,Sheet	Batch	792	1948	Unk	None	4.5	Unk	None	4.5	FLA,FLP,AE	Direct
	03(a)	Strip	Cont.	1692	1937	149	Unk	17	149	Unk	17	SL,T,CY,	Direct
	04(a)	Strip	Cont.	2496	1957	136	23	14.4	136	23	14.4	CNT,OT	Direct
	05(a)	Sheet	Cont.	1797	1945	143	Unk	18	143	Unk	18	None	Direct
	06(a)	Sheet	Cont.	1875	1951	11.5	Unk	29.2	0	0	29.2		Direct
	07(a)	Sheet	Cont.	1875	1951	127	Unk	8.4	127	0	8.4	SS,SCR,NL	Direct
	08(a)	Strip	Cont.	1032	1963	338	16.7	27.9	338	16.7	27.9	FLA,FLP,AE	Direct
	09(a)	Strip	Cont.	Est 840	1966	423	520.6	30.9	432	520.6	30.9	SL,T,CY,	Direct
	10(a)	Strip	Cont.	Est 540	1956	80	None	34.7	80	None	34.7	CNT, (Lines	Direct
	11(a)	Strip	Cont.	864	1970	170	16.7	11.7	20.4	0	11.7	07,08,09,10,12,13	Direct
	12(a)	Strip	Cont.	Est 540	1957	80	None	34.7	80	None	34.7	OT) and (Line 11	Direct
	13(a)	Strip	Cont.	Est 540	1958	80	None	34.7	80	None	34.7	Recycle)	Direct

TABLE III-4
SULFURIC ACID PICKLING SUMMARY TABLE
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Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton)			Discharge Flow (Gallons/ton)			Treatment Components	Dis-charge Mode
						Rinses	Scrubber	Conc.	Rinses	Scrubber	Conc.		
0112B	01(a)	Billets	Batch	Est 240	1948	Unk	None	Unk	Unk	None	Unk$^{(1)}$	NU,OT	Direct
0112C	01(a)	Bars,Plate, Auto Sections	Batch	261	1926	Unk	None	22.1	Unk	None	22.1	NC,SSP,FDSP	Direct
	02(a)	Square Billets	Batch	1611	1928	Unk	None	8.9	Unk	None	8.9	T,SS,CT,AE	Direct
	03(a)	Square Billets	Batch	942	1930	Unk	None	9.9	Unk	None	9.9	OT	Direct
0112D	01(a)	Black Plate	Cont.	1156.2	1966	Unk	16.2	Unk	Unk	16.2	Unk	SS,CR,FLP,NL NW,CL,CNT,OT	Direct
0112F	01	Billets,Specialty	Batch	588	1960	5.1	None	5.1	5.1	None	5.1	NC,OT	POTW
	02(a)	Rod,Wire	Batch	238.8	1948	3.8	None	3.8	3.8	None	3.8	NU,CNT,OT	POTW
0112G	01(a)	Wire	Batch	39	1929	Unk	None	Unk	Unk	None	Unk	NC,CNT,OT	POTW
	02(a)	Fasteners	Batch	5.25	1952	Unk	None	Unk	Unk	None	Unk		POTW
0112I	01(a)	Fasteners	Batch	3.57	1955	Unk	None	10.5	Unk	None	10.5	NL,NW,T,FDSP SL,SS,CNT,OT	Direct
	02(a)	Bar,Rod,Plate, Washer	Batch	146.1	1970	Unk	None	20.5	Unk	None	20.5	SL,NL,NW	Direct
	03(a)	Fasteners	Batch	64.8	1922	Unk	None	14.8	Unk	None	14.81	CNT,OT	Direct
	04(a)	Sluges,Couplings	Batch	44.1	1973	Unk	None	25.9	Unk	None	25.9	NL,NW,FDSP	Direct
	05(a)	Fasteners	Batch	138	1956	604	None	33.7	604	None	33.7	T,SS,SL,AE	Direct
	06(a)	Rods,Angles	Batch	16.35	1962	Unk	None	110	Unk	None	110	CNT,OT	Direct
	07(a)	Wire	Batch	282	1950	Unk	None	22.3	Unk	None	0	OT,AU	Direct
0176	01	Strips-Specialty	Cont.	10.2	1959	847	353	Unk	847	353	Unk	NW,NAL,NC,SL,PSP, SSP,T,SS,CY,CR, CO,CLA,EB,FLP,CL, CNT,OT	Direct
0196A	*	*	*	*	*	*	*	*	*	*	*	*	*
0240A	01	Bars,Billets, Specialty	Batch	585	1942	85.4	None	Unk	85.4	None	Unk	NL,SSP,OT	Direct
0240B	01(a)	Bars,Tubes	Batch	687	1919	62.9	None	10.5	62.9	None	10.5	NL,NW,T,SS,SL, AE,VF,CNT,RE	Direct
0240C	01(a)	Tubes	Batch	102	1973	141	1059	3.8	100	41	3.8$^{(1)}$	OT,None	Direct
0248A	01	Bars,Specialty	Batch	192	1912	84.4	None	9.4	54.4$^{(1)}$	None	9.4$^{(1)}$	OT, None	Hauled
	02	Bars,Specialty	Batch	1275	1912	6.0	None	8.1	6.0$^{(1)}$	None	8.1$^{(1)}$	OT, None	Hauled
	03	Bars,Specialty	Batch	900	1912	10.0	None	10.0	10.0$^{(1)}$	None	10.0$^{(1)}$	OT, None	Hauled
0256A	01(a)	Strip	Cont.	414	1941	209	104	9.7	209	104	9.7$^{(1)}$	NC,OT	POTW
0256B	01(a)	Strip	Cont.	423.3	1949	425	425	15	0	425	15	NL,OT	Direct
0256C	01(a)	Strip	Cont.	1468.8	1955	29.4	None	11.0	29.4$^{(1)}$	None	11.0$^{(1)}$	OT, None	Direct
	02(a)	Strip	Cont.	1468.8	1960	29.4	None	11.0	29.4$^{(1)}$	None	11.0$^{(1)}$	OT, None	Direct
0256F	01(a)	Tubes	Batch	75	1953	960	None	4	960	None	4$^{(1)}$	FLL,FLA,FLP,NL, NAL,CNT,OT	Direct
0256G	01(a)	Tubes	Batch	471	1940	107	None	18.3	0	None	18.3$^{(1)}$	NL,RE, RT	Direct
0264	01(a)	Rod	Batch	161.4	1957	382	None	17.1	382	None	17.1	IX,NAM,ReT	POTW

TABLE III-1
SULFURIC ACID PICKLING SUMMARY TABLE
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Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton) Rinses	Applied Flow (Gallons/ton) Scrubber	Applied Flow (Gallons/ton) Conc.	Discharge Flow (Gallons/ton) Rinses	Discharge Flow (Gallons/ton) Scrubber	Discharge Flow (Gallons/ton) Conc.	Treatment Components	Discharge Mode
0264C	01(a)	Rod	Batch	152.7	1969	589	None	11.8	589	None	11.8	NAM,CL,RT	POTW
0264D	01(a)	Rod	Batch	284.1	1956	446	None	13.6	446	None	13.6	CNT,NAM,CL,ReT	POTW
0384A	01	Billets,Bars, Specialty	Batch	261	1939	1379	None	14.3	1379	None	14.3	DW,FLL,FLA,SS CT,CNT,(Line 01-ReT)	Direct
	02	Bars,Coils, Specialty	Batch	240	1969	180	1200	2.5	120	156	2.5	(Line 02-OT)	Direct
	03(a)	Strip	Cont.	84	1958	4114	None	51.4	4114	None	51.4	DW,SS,SL,CNT	Direct
0386E	01(a)	Strip	Cont.	900	1953	328	Dry	32	328	Dry	32(1)	OT	Direct
	02(a)	Sheet	Batch	179.1	1970	80.4	Dry	44.2	80.4	Dry	44.2(1)	OT	Direct
0432A	01(a)	Strip	Cont.	2088	1947	115	None	14.4	115	None	14.4(1)	FT,SS,E,NL,NC	Direct
	02(a)	Pipe	Batch	253.5	1930	Unk	None	26	Unk	None	26(1)	FLP,VF,CL,T	Direct
	03(a)	Blooms	Batch	801	1927	Unk	None	25.1	Unk	None	25.1(1)	CNT,OT	Direct
	04(a)	Bar,Rod,Wire	Batch	750	1945	Unk	None	19.2	Unk	None	19.2(1)		Direct
0432B	01(a)	Strip	Cont.	1686	1936	427	Unk	17	427	Unk	17(1)	NL,OT	Direct
0432E	01(a)	Tubes	Batch	30	1942	1200	None	3.33	1200	None	3.33(1)	OT, None	POTW
0432L	01(a)	Tubes	Cont.	322.8	1949	1200	None	3.33	1200	None	3.33(1)	OT, None	Direct
0432H	01(a)	Strip	Cont.	307.2	1954	469	234	7.8	469	234	7.8(1)	OT, None	Direct
0460A	01(a)	Rod,Wire	Batch	699	1917	824	None	25.8	824	None	28.5	AE,PSP,NL	Direct
	02(a)	Rod,Wire	Batch	138	1939	4174	None	47.8	4174	None	47.8	FLL,CL,SL,	Direct
	03(a)	Rod,Wire	Batch	444	1958	973	None	27.0	973	None	27.0	CNT,OT	Direct
0460C	01(a)	Rods	Batch	105.3	1965	410	None	12.5	410	None	12.5(1)	NL,CL,OT	Direct
0460D	01(a)	Rods,Wire	Batch	238.8	1927	161	None	28.9	181	None	28.9	FLP,NL,VF,T, CL,CNT,OT	Direct
0460E	01(a)	Rod,Wire	Batch	180	1947	280	None	13.3	280	None	13.3	FDSP,NL,NC,NA FLP,OT	Direct
0460F	01(a)	Rod,Wire	Batch	27.6	1965	261	None	32.6	261	None	32.6	NL,CNT,OT	POTW
0460G	01(a)	Rod,Wire	Batch	225	1968	224	None	22.7	224	None	22.7	SL,NW,CNT,OT	POTW
0460H	01(a)	Rod	Batch	94.2	1920	535	306	27.7	535	0	27.7(1)	OT,None	POTW
0476A	01(a)	Rod,Strip	Batch	69.6	1930	414	None	12.9	424	None	12.9 AR	SCR,SS,NL,AE,OT	Direct
	02(a)	Pipe,Tubes	Batch	1800	1930	[91]	None	50.0	[91]	None	50.0 AR	CL,FLP,VF	Direct
	03(a)	Strip	Cont.	127.2	1948	283	226	11.3	283	226	11.3 AR	AU,CNT,E	Direct
0492A	01(a)	Pipe	Batch	186	1962	1355	None	32.3	1355	None	32.3	NW,SL,OT	Direct
	02(a)	Tubes	Batch	287.7	1970	2085	None	15.6	2086	None	15.6	CNT	Direct
0528A	01(a)	Strip	Cont.	782.7	1949	Unk	Unk	Unk	Unk	Unk	Unk(1)	VF,FLL,FLP,FDSP	Direct
	02(a)	Strip	Cont.	2577	1954	19.6	55.7	14.7	19.6	55.7	14.7(1)	IX,NL,Scr,CL,CT FHS,T,SS,SSP,SL, CNT,OT	Direct
0548	01(a)	Tubes	Batch	22.8	1927	853	None	8.9	853	None	8.9	NL,SL	Direct
	02(a)	Tubes	Batch	204.3	1945	961	846	9.0	453	0	9.0	CNT,(Lines	Direct
	03(a)	Tubes	Batch	186	1953	960	None	9.0	839	None	9.0	01,03,04,OT)	Direct
	04(a)	Tubes	Batch	51	1966	965	None	9.1	847	None	9.1	(Line 02,RT)	Direct
0548B	01(a)	Pipe	Batch	44.4	1947	649	None	27.0	649	None	27.0(1)	CNT,OT	POTW

TABLE III-1
SULFURIC ACID PICKLING SUMMARY TABLE
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Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton)			Discharge Flow (Gallons/ton)			Treatment Components	Dis-charge Mode
						Rinses	Scrubber	Conc.	Rinses	Scrubber	Conc.		
0580	01(a)	Wire	Batch	0.9	1960	4000	None	16.7	4000	None	16.7	OT, None	POTW
	02(a)	Wire	Batch	2.4	1965	1800	None	31.3	1800	None	31.3	OT, None	POTW
	03(a)	Wire	Batch	0.6	1965	10000	None	20.0	10000	None	20.0	OT, None	POTW
0580C	01(a)	Strip	Cont.	45	1955	1184	None	10.4	1184	None	10.4$^{(1)}$	NL,CNT,ReT	POTW
0584C	01(a)	Sheet,Plate	Batch	462	1920	62.3	None	9.7	62.3	None	9.7$^{(1)}$	SS,SL,CLB,CNT,OT	Direct
0584E	01(a)	Sheet	Cont.	4458	1961	300	74	15.8	300	74	15.7	FLL,FLP,NL,IX CL,SL,CNT,BO,CR, GF,CO,DW,EB,SS,OT	Direct
0612	01(a)	Rod	Batch	1137	1960	[122]	None	[3.5]	[122]	None	[3.5]	NL,CO,FLP,CL,VF, FDSP,CNT,ReT,E	Direct
0636	01(a)	Tubes,Bars	Batch	Unk	1943	Unk	None	Unk	Unk	None	Unk	CNT,OT	POTW
	02(a)	Tubes,Bars	Batch	Unk	1943	Unk	None	Unk	Unk	None	Unk		POTW
0640	01(a)	Rod	Batch	738	1917	898	None	27.6	898	None	27.6	NL,CL,T,SL,CNT,OT	Direct
	02(a)	Wire	Batch	19.8	1953	8291	None	7.6	8291	None	7.6	CNT,OT	Direct
0684C	01(a)	Strip	Cont.	1014	1936	284	142	21.3	284	142	21.3$^{(1)}$	NW,CNT,OT,FHS	Direct
0684D	01	Blooms,Billets, Specialty	Batch	Inactive	Unk	Unk	None	Unk	Unk	NOne	Unk$^{(1)}$	SS,SL,CNT	Direct
	02	Rounds	Batch	Est 348	1924	8.3	None	8.9	8.3	None	8.9$^{(1)}$	OT	Direct
	03	Rounds,Squares, Specialty	Batch	Est 930	1952	[12.2]	None	8.9	[12.2]	None	8.9$^{(1)}$	OT	Direct
0684E	01	Blooms,Billets, Specialty	Batch	Est 459	1939	15.7	None	17.5	15.7	None	17.5$^{(1)}$	NA,OT	Direct
	02	Bars,Specialty	Batch	Est 123	1939	820	None	17.5	820	None	17.5$^{(1)}$	SL,SS,CNT,OT	Direct
	03	Bars,Coils, Specialty	Batch	Est 528	1939	297	None	17.5	297	None	17.5$^{(1)}$	OT, None	Direct
	04	Bars,Billets, Specialty	Batch	Est 525	1942	41	None	17.5	41	None	17.5$^{(1)}$	SL,SS,CNT,OT	Direct
0684G	01	Billets	Batch	663	1929	54.3	None	3.5	54.3	None	3.5$^{(1)}$	PSP,NW,NL,FLP, SS,CL,VF,CNT,OT	Direct
	02(a)	Bars,Shape	Batch	483	1950	74.5	None	11.9	74.5	None	11.9$^{(1)}$	PSP,NW,NL,FLP, FLL,CNT,OT	Direct
0864H	01(a)	Bars,Rod	Batch	315.6	1960	913	None	25.3	913	None	25.3$^{(1)}$	CNT,CL,NL,FLL, FLP,VF,CNT,(Line 01 OT),	Direct
	02(a)	Bar,Rod,Wire	Batch	320.4	1957	2697	None	Unk	2023	None	Unk$^{(1)}$	(Line 02,RT)	Direct
0684K	*	*	*	*	*	*	*	*	*	*	*	*	*
0684N	*	*	*	*	*	*	*	*	*	*	*	*	*
0684P	01(a)	Bar	Batch	405	1900	11.2	None	9.9	11.2	None	9.9$^{(1)}$	OT, None	Direct
	02(a)	Wire	Batch	198	1900	40.3	None	10.0	40.3	None	10.0$^{(1)}$	OT, None	Direct
	03(a)	Bars	Batch	43.2	1900	17.4	None	10.0	17.4	None	10.0$^{(1)}$	OT, None	Direct
0684Q	01(a)	Bars	Batch	372	1930	215	None	24.6	21.5	None	24.6$^{(1)}$	VF,FLL,NL,CL,OT	Direct
0684V	01(a)	Plate	Batch	149.7	Unk	164	None	21.0	164	None	21.0$^{(1)}$	OT, None	Direct
0684Y	*	*	*	*	*	*	*	*	*	*	*	*	*

TABLE III-1
SULFURIC ACID PICKLING SUMMARY TABLE
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Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton) Rinses	Applied Flow (Gallons/ton) Scrubber	Applied Flow (Gallons/ton) Conc.	Discharge Flow (Gallons/ton) Rinses	Discharge Flow (Gallons/ton) Scrubber	Discharge Flow (Gallons/ton) Conc.	Treatment Components	Discharge Mode
0728	01(a)	Pipe	Batch	75	1951	288	None	7.8	0(1)	None	7.8(1)	SSP, NL, SL, CT, CNT	Direct
0760	01(a)	Strip	Cont.	481.8	1958	11.0	299	7.2	11.0	6.0	7.2	VF, AU, CY, CNT	POTW
0776D	*	*	*	*	*	*	*	*	*	*	*	*	*
0792B	01(a)	Strip	Cont.	480	1966	18.0	None	18.0	0 AR	None	18	AR, AU, VS	Direct
0792C	01(a)	Strip	Cont.	4860	1968	127	237	39.0	127	0	39	FLW, NW, CNT, OT	POTW
0796A	*	*	*	*	*	*	*	*	*	*	*	*	*
0796B	*	*	*	*	*	*	*	*	*	*	*	*	*
0856D	01(a)	Strip	Cont.	1626	1938	310	44	15.9	310	44	15.9	SS, NL, FLP,	Direct
	02(a)	Strip	Cont.		1938	143	143	115	143	143	11.5	T, CNT,	Direct
	03(a)	Strip	Cont.	2226	1947	128	97	13.0	129	97	13	OT	Direct
	04(a)	Strip	Cont.	2344	1971	225	20.5	20.2	225	20.5	10.2		Direct
0856E	01	Strip, Specialty	Cont.	285	1957	758	253	21.4	758	253	21.4	SSP, OT	Direct
0856F	01(a)	Sheet	Cont.	2559	1952	54	62	18.0	54	113	18(1)	CR, NL, NW,	Direct
	02(a)	Pipe	Batch	222	1953	1126	8432	4.1	1126	162	4.1(1)	FLL, SS, CL	Direct
	03(a)	Rod	Batch	156	1972	346	2677	7.7	346	185	7.7(1)	CNT, OT	Direct
0856N	01	Bar, Specialty	Batch	300	1970	432	1920	20	432	240	20(1)	OT, None	Direct
	02(a)	Pipe	Batch	276	1908	209	None	21.7	209	None	21.7(1)	OT, None	Direct
	03	Bar, Specialty	Batch	270	1970	160	1067	11.1	160	133	11.1(1)	OT, None	Direct
0856P	01(a)	Strip	Cont.	771	1940	1.95	232	27.5	1.95	232	27.5(1)	CNT, OT	Direct
	02(a)	Rod, Wire	Batch	828	1964	696	None	13.5	696	None	13.5(1)	CNT, OT	Direct
0856Q	01(a)	Bar, Pipe	Batch	187.5	1947	480	None	15	480	None	15(1)	CNT, OT	Direct
0856R	01(a)	Bar	Batch	117	1942	Unk	None	8.5	Unk	None	8.5(1)	OT, None	Direct
0856S	01(a)	Rod, Wire	Batch	148.2	1917	134	None	2.76	134	None	2.76(1)	NC, OT	POTW
0856T	01(a)	Slabs	Batch	230.4	1935	55.8	None	5.6	55.8	None	5.6(1)	OT, None	Direct
0856U	01(a)	Rod, Skelp, Strip Shed, Plate, Bar	Batch	186	1935	62	None	23.7	62	None	23.7	NW, OT	Direct
	02(a)	Strip	Cont.	339	1950	467	None	12.7	467	None	12.7	NW, CNT, OT	Direct
0860F	01(a)	Rod	Batch	1083	1942	465	None	16.6	465	None	16.6	DW, CNT, NL, NA, VF, CT, T, SSP, OT	Direct
0860G	01(a)	Rod, Wire	Batch	735	1943	862	None	22.4	78	None	22.4	DW, NL, CL, FLP, RTP	POTW
0864B	01(a)	Rod, Wire	Batch	651	1940	398	None	9.2	398	None	9.2	FLL, FLP, NL,	Direct
	02(a)	Strip	Cont.	846	1951	170	None	24.8	170	None	24.8	NAL, CL, SS	Direct
	03(a)	Strip	Cont.	561	1958	257	None	37.4	257	None	37.4	OT	Direct
	04(a)	Strip	Cont.	759	1964	190	None	27.7	190	None	27.7		Direct
0868A	01(a)	Rod	Batch	588	1914	349	None	5.0	340	None	5.0	NL, CL, OT	Direct
	02(a)	Strip, Sheet	Cont.	444	1943	162	908	405	162	0	40.5	FLP, CNT, NL, DW,	Direct
	03(a)	Strip, Sheet	Cont.	450	1944	96	448	36.8	96	0	36.8	CL, SL, SS, OT	Direct
	04(a)	Strip, Sheet	Cont.	543	1955	133	597	45.6	133	0	45.6		Direct
	05(a)	Strip, Sheet	Cont.	2088	1961	345	34.5	23.9	345	34.5	23.9		Direct
0884C	01(a)	Tubes	Batch	18	1961	400	None	25.0	400	None	25.0	NC, OT	Direct

TABLE III-1
SULFURIC ACID PICKLING SUMMARY TABLE
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Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton) Rinses	Applied Flow (Gallons/ton) Scrubber	Applied Flow (Gallons/ton) Conc.	Discharge Flow (Gallons/ton) Rinses	Discharge Flow (Gallons/ton) Scrubber	Discharge Flow (Gallons/ton) Conc.	Treatment Components	Dis-charge Mode
0884D	01(a)	Tubes	Batch	18	1969	1200	None	16.7	1200	None	16.7	NC,SL,OT	Direct
0884G	01(a)	Tubes	Batch	7.8	1973	77	None	11.0	77	None	11.0	VF,CL,NL,OT	Direct
0916A	01(a)	Pipe	Batch	600	1931	165	None	15.0	0	None	15(1)	None	Direct
	02(a)	Tubes	Batch	12	1931	42	None	18.0	0	None	18(1)	None	Direct
0920D	01(a)	Pipe	Batch	267	1940	1079	None	33.7	1079	None	33.7(1)	OT, None	Direct
0946A	01(a)	Billets	Batch	162.3	Unk	6.4	None	10.4	6.4	None	10.4(1)	OT, None	Direct
	02(a)	Bar,Wire	Batch	219	Unk	8.6	None	18.8	8.6	None	18.8(1)	OT, None	Direct
	03(a)	Bar	Batch	172.5	1964	3.5	None	5.4	3.5	None	5.4(1)	OT, None	Direct
0948A	01(a)	Pipe	Batch	189	1922	3810	None	48.9	3810	None	48.8(1)	CNT,CO,FLL,FLP VF,CL,OT	Direct
0948B	01(a)	Bars	Batch	306.3	1947	1081	None	Unk	1081	None	Unk(1)	OT, None	Direct
0948C	01(a)	Strip	Cont.	699	1930	874	None	21.4	412	None	10.7	CNT,FLL, FLP,T,E SS,OT,NL	Direct
	02(a)	Strip	Cont.	699	1930	422	None	21.4	422	None	10.7		Direct
	03(a)	Sheet	Cont.	1761	1954	303	None	13.6	303	None	13.6		Direct
	04(a)	Strip	Cont.	2685	1965	161	None	11.3	161	None	11.3		Direct

TABLE III-1
SULFURIC ACID PICKLING SUMMARY TABLE
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KEY TO ABBREVIATIONS

AD : Acid Disposal
ARF : Recovery of Acid via Fume Filters
AH : Acid Rinse Hauled
CH : Concentrate Hauled
CSD : Centrifuge Sludge Dewatering
CSR : Contractor Sludge Removal
DC : Dechlorination (Sulfur Dioxide)
DU : Disposal Unknown
EL : Equalization Lagoon
ES : Estimated
FIR : Ferrous Iron Removal by Air Sparging
FLFC : Flocculation with Ferric Chloride
FLW : Flocculation with Wastes
FLWPL : Flocculation with Waste Pickle Liquor
LS : Lamella Separator
N/A : Not Applicable
NAL : Neutralization with Alum
NAM : Neutralization with Ammonia
NU : Neutralization with Unknown
NR : Not Reported
pHS : pH Stabilization
RA : Reactor
RU : Rinses Untreated
SAPT : Sent to Another Plant for Treatment
SP : Scale Pit
SPI : Sewage Plant
ST : Settling Tank
TR : Treatment
UA : Acid Untreated
UFSF : Up Flow Sand Filters with Steam Backwash
UNK : Unknown

* : Confidential Data
(a) : Carbon Steel Mill
: Number in brackets represents values received in the responses to the detailed questionnaires.
(1) : Indicates wastewater eliminated by contract hauling

NOTE : See Table VII-1 for other general abbreviation.
[ ] : Number in brackets represents values received in the responses to the detailed questionnaires.

TABLE III-2

PICKLING - HYDROCHLORIC ACID - BATCH AND CONTINUOUS
SUMMARY TABLE

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/Ton) Rinses	Applied Flow (Gallons/Ton) Scrubber	Applied Flow (Gallons/Ton) Conc.	Avs.	Discharge Flow (Gallons/Ton) Rinses	Discharge Flow (Gallons/Ton) Scrubber	Discharge Flow (Gallons/Ton) Conc.	Avs.	Treatment Components	Discharge Mode
0020C	01	S.Specialty	Cont.	582	1946	958	7.4	35	-	958	7.4	35	-	CR,NL,FLP,CL,VF	Direct
0060	01(a)	Strip	Cont.	3900	1969	295	86.8	14.8	-	295	12.9	14.8	-	DW,NL,FP,AE FLP,SL,CL,VF	Direct
	02(a)	Strip	Cont.	4206	1969	274	8.4	13.7	-	274	12.0	13.7	-		Direct
0060B	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
0060D	01	Strip-Specialty	Cont.	207	1972	348	696	13.2	-	348	696	13.2	-	NW,NL,SL	Direct
0060L	01(a)	Tube	Batch	0.375	1974	13400	-	4.0	-	13400	-	4.0		NL	POTW
0068	01(a)	Fence	Cont.	103.8	1934	1386	-	5.4	-	693	-	5.4	-	Unknown	POTW
	02(a)	Wire	Cont.	88.8	1947	367	-	8.0	-	70.8	-	8.0	-	Unknown	POTW
088A	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
0112B	01(a)	Strip	Cont.	1425	1936	Unk	202	Unk		Unk	202	Unk	-	SSP,AE,FPSP, SS,CL	Direct
	02(a)	Strip	Cont.	2589	1936	Unk	111	Unk		Unk	111	Unk	-		Direct
	03(a)	Strip	Cont.	1578	1936	Unk	183	Unk		Unk	183	Unk	-		Direct
0112D	01(a)	Strip/Sheet	Cont.	3672	1965	Unk	58**	Unk	-	Unk	Unk	Unk	-	SS,CL,FLP,NL, NW,CO,SL	Direct
	02(a)	Strip/Sheet	Cont.	4788	1969	Unk	45**	Unk	-	Unk	Unk	Unk	-		Direct
0112H	01(a)	Wire	Cont.	40.2	1971	Unk	358**	20.9	-	Unk	Unk	20.9	-	NL,FLL,CL,SL	Direct
0176	01	Wire-Specialty	Batch	15.9	1961	1811	-	Unk	-	1811	-	Unk	-	CO,CR,CLA,EB,FLP, NC,NW,NA,CL,SC, PSP,SSP,T,SS,CY, CNT	Direct
0320	01(a)	Sheet	Cont.	2023.2	1936	Unk	214**	6.6	-	Unk	214	6.6	-	PSP,CL,SL,SS,NC	Direct
	03(a)	Sheet	Cont.	1821.6	1939	Unk	210	6.5	-	Unk	210	6.5	-		Direct
	04(a)	Sheet	Cont.	2990.4	1967	Unk	144	6.1	-	Unk	144	6.1	-		Direct
0384A	01(a)	Strip	Cont.	639	1932	763	611	13.6	-	763	611	13.6	-	SS,SI	Direct
	02(a)	Strip	Cont.	133.5	1932	372	298	8.3	-	372	298	8.3	-		Direct
	03(a)	Strip	Cont.	118.8	1951	450	463	7.7	-	450	463	7.7	-		Direct
	04(a)	Strip	Cont	[9198]	1958	[37.6]	[3.4]	7.2	-	[37.6]	[3.4]	7.2	-	PSP,SS,CC	Direct
	06(a)	Sheet	Batch	768	1948	469	169	4.4	-	469	169	4.4	-	SL,PSP,SS	Direct
0396D	01(a)	Strip	Cont.	226.8	1967	[40.6]	[6.2]	[40.6]	-	[40.6]	[6.2]	[40.6]		CNT,NL,E,CL,VF	POTW
	02(a)	Strip	Cont.	226.8	1967	[40.6]	[6.2]	[40.6]	-	[40.6]	[6.2]	[40.6]			POTW
	03(a)	Strip	Cont.	226.8	1967	[40.6]	[6.2]	[40.6]	-	[40.6]	[6.2]	[40.6]			POTW
	04(a)	Strip	Cont.	226.8	1967	[40.6]	[6.2]	[40.6]	-	[40.6]	[6.2]	[40.6]			POTW
	05(a)	Strip	Cont.	226.8	1967	[40.6]	[6.2]	[40.6]	-	[40.6]	[6.2]	[40.6]			POTW
0432C	01(a)	Strip	Cont.	2193	1952	246	49.2	15.8	-	246	49.2	15.8	-	VF,FLL,FLP,NW,CL,	Direct
	02(a)	Strip	Cont.	2259	1957	239	47.8	15.3	-	239	47.8	15.3	-	PSP,SS,CT	Direct
0432D	01(a)	Strip/Sheet	Cont.	3678	1968	596	78.3	8.5	-	596	78.3	8.5	-	FP,DW,FLL,T,FLWPL	Direct
0448A	01(a)	Sheet	Cont.	2004.3	1954	Unk	Unk	9.8	-	Unk	Unk	9.8	-	NAM	POTW
	02(a)	Sheet	Cont.	792.3	1970	Unk	Unk	7.0	-	Unk	Unk	7.0	-		POTW
0528B	01(a)	Strip	Cont.	2196	1963	[216]	[6.1]	[81.7]	[176]	[216]	[6.1]	[0]	[176]	NC,SL,SS,AR	Direct

TABLE III-2
PICKLING - HYDROCHLORIC ACID - BATCH AND CONTINUOUS
SUMMARY TABLE
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Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/Ton) Rinses	Applied Flow (Gallons/Ton) Scrubber	Conc.	Avs.	Discharge Flow (Gallons/Ton) Rinses	Discharge Flow (Gallons/Ton) Scrubber	Conc.	Avs.	Treatment Components	Discharge Mode
0580	01(a)	Wire	Cont.	200.1	1960	1440	-	10.0	-	1440	-	10.0	-	None	POTW
	02(a)	Rod/Wire	Cont.	240	1965	360	72	1.8	-	360	72	1.8	-		POTW
	03(a)	Wire	Cont.	300	1965	288	288	3.0	-	288	-	3.0	-		POTW
	04(a)	Wire	Cont.	300	1965	240	-	1.5	-	240	-	1.5	-		POTW
	05(a)	Wire	Cont.	225	1965	1333	-	33.3	-	1333	-	38.3	-		POTW
	06(a)	Wire	Cont.	240	1970	360	360	3.8	-	360	360	3.8	-		POTW
0580A	01(a)	Wire Cloth	Cont.	1.5	1962	6240	-	5.9	-	6240	-	5.9	-	NL,NW,FP	Direct
	02(a)	Wire Cloth	Cont.	2.16	1962	9333	-	117.5	-	9333	-	117.5	-		Direct
	03(a)	Wire	Batch	3.69	1962	1950	-	38	-	1950	-	38	-		Direct
0580B	01(a)	Wire	Cont.	15	1965	288	288	3.0	-	288	288	3.0	-	None	POTW
	02(a)	Wire	Cont.	30	1965	240	-	1.5	-	240	-	1.5	-		POTW
	03(a)	Rod/Wire	Cont.	60	1965	360	120	1.8	-						POTW
0580C	01(a)	Strip/Band	Cont.	3	NR	1440	-	17.5		1440	-	17.5	-	NL	POTW
	02(a)	Rod/Wire	Cont.	21	1966	3017	-	13.0	-	3017	-	13.0	-		POTW
	03(a)	Wire	Cont.	15	1957	1152	-	4.4	-	1152	-	4.4	-		POTW
0580D	01(a)	Rod/Wire	Cont.	60	1965	360	120	1.8	-	360	120	1.8	-	CO,CLA,FLP,NC, CL,SL	Direct
	02(a)	Wire	Cont.	15	1965	288	288	3.0		288	288	3.0		CO,CLA,FLP, NL,CL,SL	Direct
	03(a)	Wire	Cont.	30	1965	240	144	1.5		240	0	1.5			Direct
0580E	01(a)	Rod/Wire	Cont.	60	1960	360	-	1.8	-	360	-	1.8	-	NC	POTW
	02(a)	Wire	Cont.	30	1930	240	-	1.5	-	240	-	1.5	-		POTW
0580F	01(a)	Rod/Wire	Cont.	60	1965	360	120	1.8	-	360	120	1.8	-	NC	POTW
	02(a)	Wire	Cont.	30	1965	240	144	1.5	-	240	-	1.5	-	NL,NC	POTW
0584A	01(a)	Strip	Cont.	2490	1936	217	145**	4.6	-	217	145	4.6	-	VF,FLL, FLP,NL,NW, NA,CL,T, SS	Direct
	02(a)	Strip	Cont.	2409	1936	224	149**	4.8	-	224	149	4.8	-		Direct
	03(a)	Strip	Cont.	2826	1936	191	127**	4.1	-	191	127	4.1	-		Direct
	04(a)	Strip	Cont.	2223	1957	243	162**	5.2	-	243	162	5.2	-		Direct
0584C	01(a)	Strip	Cont.	3069	1947	225	141	4.7	-	225	0.8	4.7	-	FDSP,SS,SL,CLB,DC	Direct
0584F	01(a)	Strip	Cont.	2250	1939	128	9.6	[16.6]	[23]	128	9.6	[0]	[23]	AR,SL,SS,DT	Direct
	02(a)	Strip	Cont.	2730	1956	316	264	[16.6]	[23]	316	264	[0]	[23]		Direct
	03(a)	Strip	Cont.	3345	1974	86	8.6	[16.6]	[23]	17.2	8.6	[0]	[23]		Direct
0612	01(a)	Wire	Cont.	66.9	Pre-1950	[66]	-	[3.6]	-	[66]	-	[3.6]	-	NL,CO,FLP, CL,VF,FDSP	Direct
	02(a)	Wire	Cont.	66.9	Pre-1950	[66]	-	[3.6]	-	[66]	-	[3.6]	-		Direct
	03(a)	Wire	Cont.	66.9	Pre-1950	[66]	-	[3.6]	-	[66]	-	[3.6]	-		Direct
	04(a)	Wire	Cont.	66.9	Pre-1950	[66]	-	[3.6]	-	[66]	-	[3.6]	-		Direct
	05(a)	Fence	Cont.	16.2	Pre-1950	[66]	-	[3.6]	-	[66]	-	[3.6]	-	None	Direct
0684B	01(a)	Strip	Cont.	1326	1957	109	217	8.7	-	109	217	8.7	-	SL,SS	Direct
	02(a)	Strip	Cont.	1407	1961	102	102	12.3	-	102	102	12.3	-		Direct
0684F	01(a)	Sheet/Plate	Cont.	1740	1937	500	166	7.3	-	25	21	7.3	-	NL,CO,SS,NW,FLL, FLPC,FLP,FT,CL,VF	Direct
	02(a)	Sheet/Plate	Cont.	3084	1969	305	93	8.2	-	14	12	8.2	-		Direct
0684I	01(a)	Strip	Cont.	1377	1964	272	146	13.6	376	272	136	13.6	376	PSP,SSP,SS,BO, NW,SL	Direct

TABLE III-2
PICKLING - HYDROCHLORIC ACID - BATCH AND CONTINUOUS
SUMMARY TABLE
PAGE 3

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/Ton)				Discharge Flow (Gallons/Ton)				Treatment Components	Discharge Mode
						Rinses	Scrubber	Conc.	Avs.	Rinses	Scrubber	Conc.	Avs.		
0724A	01(a)	Sheet/Strip	Cont.	360	1969	4160	300	Unk	-	4160	240	Unk	-	None	Direct
	02(a)	Sheet/Strip/ Plate	Cont.	336	1950	120	86	Unk	-	120	86	Unk	-		Direct
	03(a)	Sheet	Cont.	738	1958	137	88	Unk	-	137	78	Unk	-		Direct
	04(a)	Sheet	Cont.	1719	1966	84	17	7.3	-	84	17	7.3	-		Direct
0856F	01(a)	Sheet	Cont.	2388	1950	60	66	9.6	-	46	12	9.6	-	CR, MW, NL, FLL, SS, CL	Direct
0856P	01(a)	Wire	Cont.	16.86	1917	15540	15125	5.9	-	15540	0	5.9	-	None	Direct
0856S	01(a)	Wire	Cont.	18.99	1927	589	-	0.8	-	589	-	0.8	-	NC	POTW
	02(a)	Wire	Cont.	5.43	1937	1309	-	2.4	-	1309	-	2.4	-		POTW
0860F	01(a)	Wire	Cont.	69	1942	3130	-	2.0	-	188	-	7.0	-	NL, SSP, FPSP, VF, CT, FP	Direct
0864B	02(a)	Wire	Cont.	28.2	1963	766	-	5.3	-	766	-	5.3	-	SS, NL, FLL, FLP, CL, NA, pHS	Direct
	03(a)	Strip	Cont.	1440	1967	400	25	12	-	150	0	12	-		Direct
	04(a)	Strip	Cont.	1965	1951	330	18	8.8	-	183	0	8.8	-		Direct
	05(a)	Pipe	Batch	273	1966	1319	132	6.6	-	1055	0	6.6	-		Direct
0868A	01(a)	Strip	Cont.	1590	1968	299	45	25.4	-	299	5.4	25.4	-	FLP, FLWPL, NL, FP CL, SL, SS	Direct
0920A	01(a)	Sheet	Cont.	1761	1930	270	16	18.7	-	245	18	18.7	-	EB, FLL, CO, IX, CL, VF	Direct
	02(a)	Sheet	Cont.	1638	1966	290	13	19.3	-	264	18	19.3	-		Direct
0920C	01(a)	Strip	Cont.	2445.9	1953	258	24	7.4	-	212	25	7.4	-	NL, FLP, SS, VF	Direct
0920G	01(a)	Strip	Cont.	2133	1958	225	-	7.0	-	225	-	7.0	-	CR, NL, FLL, FLP, CL	Direct
0948A	01(a)	Strip	Cont.	1428	1935	61	454	3.7		50	10	3.7	-	CO, FLL, FLP, CL, VF	Direct
	02(a)	Strip	Cont.	1209	1935	71	536	4.4		60	12	4.4	-		Direct

TABLE III-2
HYDROCHLORIC ACID PICKLING SUMMARY TABLE
PAGE 4

KEY TO ABBREVIATIONS

AD : Acid Disposal
ARF : Recovery of Acid via Fume Filters
AH : Acid Rinse Hauled
CH : Concentrate Hauled
CSD : Centrifuge Sludge Dewatering
CSR : Contractor Sludge Removal
DC : Dechlorination (Sulfur Dioxide)
DU : Disposal Unknown
EL : Equalization Lagoon
ES : Estimated
FIR : Ferrous Iron Removal by Air Sparging
FLFC : Flocculation with Ferric Chloride
FLW : Flocculation with Wastes
FLWPL : Flocculation with Waste Pickle Liquor
LS : Lamella Separator
N/A : Not Applicable
NAL : Neutralization with Alum
NAM : Neutralization with Ammonia
NU : Neutralization with Unknown
NR : Not Reported
pHS : pH Stabilization
RA : Reactor
RU : Rinses Untreated
SAPT : Sent to Another Plant for Treatment
SP : Scale Pit
SPI : Sewage Plant
ST : Settling Tank
TR : Treatment
UA : Acid Untreated
UFSF : Up Flow Sand Filters with Steam Backwash
UNK : Unknown

* : Confidential Data
** : Design Flow
(a) : Carbon Steel Mill
[ ] : Number in brackets represents values received in the responses to the detailed questionnaires.

NOTE : See Table VII-1 for other general abbreviation.

TABLE III-3

COMBINATION ACID PICKLING, CONTINUOUS AND BATCH TYPE MILLS
SUMMARY TABLE

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton) Rinses	Applied Flow (Gallons/ton) Scrubber	Applied Flow Conc.	Discharge Flow (Gallons/ton) Rinses	Discharge Flow (Gallons/ton) Scrubber	Discharge Flow Conc.	Treatment Components	Discharge Mode
0020B	01	Sheet,Strip,Skelp H_2SO_4,HNO_3,HF	Cont.	324	1952	1333	222	15.5	1333	222	15.5	CNT,CR,VF, FLP,NR,CL	Direct
	02	Sheet,Strip, H_2SO_4,HNO_3,HF	Cont.	210	1957	1029	343	24.7	1029	343	24.7	CNT,CR,VF, FLP,NL,CL, FHS	Direct
	03	Sheet,Strip, H_2SO_4,HNO_3,HF	Batch	99	1967	2182	-	52.1	2182	-	52.1	CNT,CR,VF, FLP,NL,CL	Direct
0020C	01	Sheet,Strip, H_2SO_4,HNO_3,HF	Cont.	207.6	1951	4127	20.8	Unk	4127	20.8	Unk	CNT,CR,VF, FLP,NL,CL	Direct
	02	Sheet,Strip, HNO_3,HF	Cont.	93.9	1966	6288	1380	Unk	6288	1380	Unk	CNT,CR,VF, FLP,NL,CL	Direct
	03	Sheet,Strip, H_2SO_4,HF,HNO_3	Cont.	93.8	1966	6288	1380	Unk	6288	1380	Unk		Direct
	04	Sheet,Strip, H_2SO_4,HF,HNO_3	Cont.	58.8	1930	9388	561	Unk	9388	561	Unk	CNT,CR,VF, FLP,NL,CL	Direct
	05	Sheet,Strip, H_2SO_4,HF,HNO_3	Cont.	100.2	1965	5509	329	Unk	5509	329	Unk		Direct
	06	Strip,HCl/HF	Cont.	88.6	1966	2271	102	Unk	2271	102	Unk	CNT,CR,VF, FLP,NL,CL	Direct
	07	Sheet,Strip, H_2SO_4,HNO_3/HF	Cont.	262.8	1957	2900	1096	Unk	2900	1096	Unk	CNT,CR,VF, FLP,NL,CL	Direct
0020L	01	Sheet,H_2SO_4, HNO_3,HF	Cont.	185.7	1966	1087	272	7.8	1087	272	7.8	CNT,CR,FLA, NL,CL	Direct
	02	Sheet,H_2SO_4 HNO_3,HCl	Cont.	199.5	1966	1011	253	7.2	1011	253	7.2	CNT,CR,FLP, NL,CL	Direct
0060	01	Strip,H_2SO_4 H_3PO_4	Cont.	307.5	1974	Unk	Unk	23.4	Unk	Unk	23.4	CNT, Spent Acid to VF,FLP, NL,CL,SL	Direct
0060D	01(a)	Strip,H_2SO_4, HNO_3,HF	Cont.	228	1927	Unk	1579	Unk	Unk	63	Unk	CNT,NL, SL,AE	Direct
	02	Strip,H_2SO_4, HF	Cont.	300	1935	Unk	1200	Unk	Unk	48	Unk		Direct
	03	Strip,H_2SO_4 HNO_3,HF	Cont.	288	1939	Unk	100	Unk	Unk	Unk	Unk		Direct
	04	Strip,H_2SO_4, HF	Cont.	435	1965	Unk	Unk	Unk	Unk	Unk	Unk		Direct
	05	Strip,HNO_3,HF	Cont.	300	1961	Unk	50.4	Unk	Unk	Unk	Unk	CNT,NL,CL, VF	Direct
	06	Strip,H_2SO_4, HNO_3,HF	Cont.	282	1961	Unk	511	Unk	Unk	Unk	Unk	CNT,NL,SL,AE	Direct
0060E	01	Strip,HCl,HF	Cont.	0	1973	1690	777	8.2	1690	777	8.2	CNT,F(Unk), FLP,NC,T	Direct

TABLE III-3
COMBINATION ACID PICKLING, CONTINUOUS AND BATCH TYPE MILLS
SUMMARY TABLE
PAGE 2

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton)			Discharge Flow (Gallons/ton)			Treatment Components	Discharge Mode
						Rinses	Scrubber	Conc.	Rinses	Scrubber	Conc.		
	02	Strip,Unk	Cont.	99.9	1970	Unk	1381	2.5	Unk	1381	2.5	CNT, F(Unk), FLP, NC, T	Direct
0060I	01	Rod,Wire, H_2SO_4, HNO_3	Batch	176.7	1946	611	-	Unk	611	-	Unk	CNT, CR, NC, NA	POTW
0060N	01	Pipe, HNO_3, HF	Batch	9.6	1970	109	-	46.9	109	-	46.9	NL, NW, SS, ST	Direct
0060P	01	Pipe, HNO_3 HF	Batch	25.5	1969	Unk	-	8.2	Unk	-	8.2	CNT, NL, SL	Direct
0068	01(a)	Rod, H_2SO_4, HCl	Batch	381	1937	162	Unk	27.6	162	Unk	27.6	AU	POTW
0088A	01	Tubes, HNO_3, HF	Batch	72	1952	[310]	-	4.1	[310]	-	4.1	CNT, E, CR, NL, FLP, CL, T, VF, SS	Direct
0088C	01(a)	Tubes, H_2SO_4, or HCl, H_3PO_4	Batch	273	1957	791	-	6.59	791	-	6.59	Unknown	Direct
	02(a)	Tubes, H_2SO_4, or HCl, H_3PO_4	Batch	273	1957	791	-	6.59	791	-	6.59		Direct
0088D	01	Tubes, HNO_3, HF	Batch	51.9	1969	[1176]	-	Unk	[1176]	-	Unk	E, NC, F(Unk), PSP	Direct
0112A	01(a)	Rod,Wire, H_2SO_4 HCl	Batch	1044	1926	Unk	-	3.9	Unk	-	3.9	CNT, SS, NL, A, FLA, Scr, FLP, SL, CY, T,	Direct
	02(a)	Wire, H_2SO_4, HCl	Cont.	96	1939	Unk	750	18.8	Unk	750	18.8	CNT, SS, Scr, NL, A, FLA, FLP, SL, CY, T	Direct
0112C	01(a)	Bar,Rod,Wire, H_2SO_4, HCl	Batch	882	1914	Unk	Unk	16.3	Unk	Unk	16.3	CNT, NL, CL, T, AE	Direct
	02(a)	Wire, H_2SO_4, HCl	Cont.	76.8	1936	7706	Unk	Unk	7706	Unk	Unk		Direct
	03(a)	Wire, H_2SO_4, HCl	Cont.	28.2	1944	Unk	Unk	Unk	Unk	Unk	Unk	CNT, NL, CL, T, AE	Direct
	04(a)	Wire, H_2SO_4, HCl	Cont.	26.4	1960	Unk	Unk	Unk	Unk	Unk	Unk	CNT, NL, CL, T, AE	Direct
0112H	01(a)	Rod,Wire, H_2SO_4 HCl	Batch	552	1940	[116]	Unk	6.52	[116]	Unk	6.52	CNT, FLA, NL, CL, SL, E	Direct
0176	01	Rod,Wire, H_2SO_4 HCl, HNO_3, HF	Batch	261.6	1940	633	3550	Unk	633	330	Unk	CNT, CLA, CR, EB, FLP, NC, NW, CL, CY	Direct
	02	Rod,Wire,Shapes, H_2SO_4, HCl, HNO_3, HF	Batch	172.5	1941	1043	2087	Unk	1043	417	Unk	CNT, CLA, CR, EB, FLP, NC, NW, NA, CL, CY	Direct

TABLE III-3
COMBINATION ACID PICKLING, CONTINUOUS AND BATCH TYPE MILLS
SUMMARY TABLE
PAGE 3

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton) Rinses	Applied Flow (Gallons/ton) Scrubber	Applied Flow (Gallons/ton) Conc.	Discharge Flow (Gallons/ton) Rinses	Discharge Flow (Gallons/ton) Scrubber	Discharge Flow (Gallons/ton) Conc.	Treatment Components	Discharge Mode
	03	Strip,H_2SO_4 HNO_3/HF	Cont.	90.3	1962	558	3189	Unk	558	80	Unk	CNT,CLA,CR, EB,FLP,NC,NW,NA, CL,CY	Direct
	04	Strip,HNO_3/HF, HNO_3	Cont.	19.8	1963	2182	1273	Unk	2182	364	Unk	CNT,CLA,CR,EB, FLP,NC,NAL,CL, T,SS,CY	Direct
	05	Strip,HNO_3, HNO_3/HF	Cont.	18	1963	2000	7000	Unk	2000	400	Unk	CNT,CLA,CR,EB, FLP,NC,NW,NA,CL,T, SS,CY	Direct
	06	Wire,HNO_3,HF	Batch	89.4	1964	805	6443	Unk	805	242	Unk	CNT,CLA,CR, EP,FLP,NC,NW,NA,CL, EB,T,SS,CY	Direct
	07	Strip,Rod,HCl, HNO_3,HF	Batch	202.8	1968	711	3689	Unk	711	284	Unk	CNT,CLA,CR, EB,FLP,NC,NW,NA, CL,T,SS,CY,	Direct
0176C	01	Pipe & Tube, HNO_3,HF	Batch	22.8	1969	1617	-	41.3	1617	-	41.3	No treatment for Rinses	POTW
0176D	01	Tubes,HNO_3,HF	Batch	9	1972	3200	960	35	3200	960	35	None	POTW
0248A	02	Strip,H_2SO_4, HNO_3,HF	Cont.	161.1	1957	358	89	1.7	358	89	1.7	CNT,CR,NL, FLP,CL,CY	Direct
0248B	01	Strip,H_2SO_4, HNO_3,HF	Cont.	264.6	1969	2721	376	13.4	1224	49	13.4	CNT,SCR,NL, FLP,CL,T,FP	Direct
	02	Strip,H_2SO_4, HNO_3,HF	Cont.	93.9	1969	7668	1702	40.2	3604	230	40.2	CNT,SCR,NL, FLP,CL,T,FP	Direct
	03	Strip,H_2SO_4, HNO_3,HF	Cont.	227.7	1969	3162	702	13.9	1233	95	13.9	CNT,SCR,NL, FLP,CL,T,FP	Direct
	04	Strip,H_2SO_4, HNO_3,HF	Cont.	169.2	1955	4255	766	13.4	1277	0	13.4	CNT,SCR,NL, FLP,CL,T,FP	Direct
	05	Strip,H_2SO_4, HNO_3,HF	Cont.	246.3	1959	2923	403	10.6	965	53	10.6	CNT,SCR,NL, FLP,CL,T,FHS,FP	Direct
	06	Strip,H_2SO_4 HNO_3,HF	Cont.	153.6	1959	4688	2344	21.1	1828	188	21.1	CNT,SCR,NL, FLP,CL,T,FHS,FP	Direct
	07	Strip,H_2SO_4, HNO_3,HF	Cont.	78.3	1961	9195	-	16.5	1563	-	16.5	CNT,SCR,NL, FLP,CL,T,FP	Direct
	08	Strip,HSO_4, HNO_3,HF	Cont.	98.4	1964	7317	-	13.1	1244	-	13.1	CNT,SCR,NL, FLP,CL,T,FP	Direct
	09	Strip,H_2SO_4, HNO_3,HF	Cont.	321.9	1964	2237	309	8.1	738	40	8.1	CNT,SCR,NL, FLP,CL,T,FP	Direct
	10	Strip,H_2SO_4, HNO_3,HF	Cont.	222.9	1973	3230	446	11.7	1066	58	11.7		Direct

TABLE III-3
COMBINATION ACID PICKLING, CONTINUOUS AND BATCH TYPE MILLS
SUMMARY TABLE
PAGE 4

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton) Rinses	Applied Flow (Gallons/ton) Scrubber	Applied Flow (Gallons/ton) Conc.	Discharge Flow (Gallons/ton) Rinses	Discharge Flow (Gallons/ton) Scrubber	Discharge Flow (Gallons/ton) Conc.	Treatment Components	Discharge Mode
0248C	01	Rod, Wire, H_2SO_4, HCl, HNO_3, HF	Batch	141	1930	1015	-	2.4	1015	-	2.4	AE, NC, FL, FLP, CL, SL, CNT	Direct
	02	Rod, Wire, HCl, HNO_3, HF	Batch	6.6	1930	8889	-	20.8	8889	-	20.8	AE, NC, FL, FLP, CL, SL, CNT	Direct
	03	Bar, H_2SO_4, HNO_3, HF	Batch	112.2	1945	2310	-	2.7	1240	-	2.7	AE, NC, FL, FLP, CL, SL, CNT	Direct
0248D	01	Pipe, Tubes, H_2SO_4, HNO_3, HF	Batch	2.7	1948	2667	-	87.8	2667	Unk	87.8	CNT, T, NL, NC, T,	Direct
	02	Pipe, Tubes, H_2SO_4, HNO_3, HF	Batch	2.7	1948	2667	-	87.8	2667	Unk	87.8		Direct
	03	Pipe, Tubes, H_2SO_4, HNO_3, HF	Batch	7.8	1958	923	-	30.4	923	Unk	30.4	CNT, T, NL, NC, T,	Direct
	04	Pipe, Tubes H_2SO_4, HNO_3, HF	Batch	8.7	1974	414	-	149	414	Unk	149		Direct
	05	Tubes, H_2SO_4, HNO_3, HF	Batch	13.5	1970	267	-	119	267	Unk	119		Direct
0248E	01	Tubes, HNO_3, HF	Batch	5.27	1958	690	-	2.93	690	-	2.93	CNT	POTW
0248F	01	Tubes, HNO_3, HF	Batch	0.84	1966	2357	Unk	1089	2357	Unk	1089	CNT, NL, SL, NL	Direct
0256F	01	Tubes, H_2SO_4, HNO_3, HF	Batch	30	1953	960	7200	9.5	960	0	9.5	CNT, FLL, FLA, FLP, NA, NL,	Direct
	02	Bar, HNO_3, Muriatic	Batch	0.25	Unk	320	-	-	320	-	-	CNT, NL, NC	POTW
256L	*	*	*	*	*	*	*	*	*	*	*	*	*
256N	01	*	*	*	*	*	*	*	*	*	*	*	* *
	02	Bar, HNO_3, Muriatic	Batch	0.25	Unk	320	-	-	320	-	-	CNT, NL, NC	POTW
02560	01	Sheet, Strip, H_2SO_4, HNO_3, HF	Cont.	165.9	1959	5729	694	11.5	4163	0	11.5	CNT, CL, FLP,	Direct
	02	Strip, H_2SO_4, HNO_3, HF	Cont.	122.4	1960	6588	941	15.3	5647	0	15.3	CNT, NL, FLP, CL	Direct
	03	Strip, H_2SO_4, HNO_3, HF	Cont.	185.9	1960	1064	268	7.5	796	0	7.5	CNT, NL, FLP, CL	Direct
	04	Strip, H_2SO_4, HNO_3, HF	Cont.	102.8	1972	6051	1532	17.0	4443	0	17.0	CNT, NL, FLP, CL	Direct

TABLE III-3
COMBINATION ACID PICKLING, CONTINUOUS AND BATCH TYPE MILLS
SUMMARY TABLE
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Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton)			Discharge Flow (Gallons/ton)			Treatment Components	Dis-charge Mode
						Rinses	Scrubber	Conc.	Rinses	Scrubber	Conc.		
0284A	01	Sheet, Plate, H_2SO_4, HNO_3, HF	Batch	177	1946	325	163	3.0	325	163	3.0	CNT, CR, SL, NL, FLP, CL, CY, SS	Direct
0424	01	Plate, H_2SO_4, HNO_3, HF	Batch	185.7	1960	93	-	10.8	93	-	10.8	CNT, FLP, NL, CL, NC, NW, SL, R	Direct
	02	Bar, H_2SO_4, HNO_3, HF	Batch	24.9	1968	463	-	45.7	463	-	45.7	CNT, FLP, NL, CL, NC, NW, SL	Direct
0430C	01	Plate, H_2SO_4, HNO_3, HF	Batch	60	1962(1977)	288	1200	72	288	1200	72	CNT, BOA(1), CLN, FLL, FLP, NL, SCR, SS, PSP, SSP, CL, SL	Direct
0432E	01	Tubes, HNO_3, HF	Batch	15	1969	3168	864	2.2	3168	864	2.2	None	POTW
0432K	02	Sheet, H_2SO_4, HNO_3, HF	Cont.	229.8	1958	Unk	94	Unk	457	94	Unk	CNT, NL, SL	Direct
	03	Sheet, H_2SO_4, HNO_3, HF	Cont.	341.4	1966	Unk	63	Unk	457	63	Unk	CNT, NL, SL	Direct
	04	Sheet, H_2SO_4, HNO_3, HF	Cont.	187.5	1958	Unk	115	Unk	Unk	115	Unk	CNT, NL, SL	Direct
0432L	01	Strip, HNO_3, HF	Cont.	33.6	1959	5571	-	18	5571	-	18	None	POTW
0440A	01	Bar, HCl, HNO_3	Batch	161.7	1958	178	-	6.9	178	-	6.9	CNT, NL, NW, SL,	POTW
	02	Rod, Wire, HCl, HNO_3, HF	Batch	75	1958	384	-	11	384	-	11		POTW
0476A	01(a)	Rod, HCl, H_2SO_4	Batch	386	1940	932	-	31.1	932	-	31.1	CNT, SCR, SS, NL, AE, FLP, CL, CY	Direct
0496	01	Plate, HNO_3, HF	Batch	411	1964	736	701	9	736	2.4	9	CNT, NL, SL	Direct
0548A	01(a)	Pipe, Tube, H_2SO_4, HNO_3, H_3PO_4	Batch	63	1957	2286	Unk	0.633	2286	Unk	0.633	CNT, NC SL	Direct
0548B	01	Tubes, HNO_3, HF	Batch	1.8	1947	3871	-	16.1	3871	-	16.1	NL, CNT	POTW
0580	01(a)	Rod, HCl, HNO_3	Batch	45	1965	667	Unk	1.0	667	Unk	1.0	None	POTW
0580G	01(a)	Rod, Wire, H_2SO_4 HCl	Batch	161.1	1950	143	Unk	1.25	143	Unk	1.25	None	POTW
0636	01	Tubes, H_2SO_4, HNO_3, HF	Batch	NA	1963	Unk	-	Unk	Unk	-	Unk	CNT	POTW
	02	Tubes, HNO_3, HF	Batch	NA	1963	Unk	-	Unk	Unk	-	Unk	CNT	POTW
	03	Tubes, HNO_3, HF	Batch	NA	1968	Unk	-	Unk	Unk	-	Unk	CNT	POTW
0640B	01(a)	Rod, Wire, H_2SO_4, HCl	Batch	171	1950	1011	Unk	33.3	1011	Unk	33.3	FLP, NC, CL, T, CNT	POTW

TABLE III-3
COMBINATION ACID PICKLING, CONTINUOUS AND BATCH TYPE MILLS
SUMMARY TABLE
PAGE 6

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton)			Discharge Flow (Gallons/ton)			Treatment Components	Dis-charge Mode
						Rinses	Scrubber	Conc.	Rinses	Scrubber	Conc.		
0648	01(a)	Rod, Wire, H_3PO_4	Cont.	129	1968	2097	400	15	404	0	15	NL	POTW
0684D	01	Strip, HNO_3, HF	Cont.	66	1947	2291	-	22.2	2291	-	22.2	CNT, SL, SS,	Direct
	02	Strip, HF, HNO_3	Cont.	0	1940	1867	-	Unk	1867	-	Unk	CNT CL	Direct
	03	Strip, HNO_3, HF	Cont.	81	1940	2044	-	23.4	2044	-	23.4	CNT SL, SS	Direct
	04	Strip, HNO_3, HF	Cont.	0	1947	4246	-	Unk	4246	-	Unk		Direct
	05	Strip, HNO_3, HF	Cont.	72	1947	2100	-	24.9	2100	-	24.9		Direct
	06	Strip, HNO_3, HF	Cont.	135	1947	1387	-	16.8	1387	-	16.8	NA	
	07	Strip, H_2SO_4, HNO_3, HF	Cont.	195	1947	1255	-	11.2	1255	-	11.2		Unk
	08	Strip, HNO_3, HF	Cont.	42	1947	4457	-	18.4	4457	-	18.4	NA	Unk
	09	Strip, HNO_3, HF	Cont.	60	1947	3120	-	25.7	3120	-	25.7		Unk
	10	Strip, HNO_3, HF	Cont.	69	1947	2713	-	7.6	2713	-	7.6		Unk
	11	Strip, HNO_3, HF	Cont.	81	1947	2222	-	22.4	2222	-	22.4		Unk
	12	Strip, HNO_3, HF	Cont.	105	1947	1714	-	18.8	1714	-	18.8		Unk
	13	Strip, HNO_3, HF	Cont.	177	1955	1383	-	12.8	1383	-	12.8		Unk
0684K	*	*	*	*	*	*	*	*	*	*	*	*	*
0684P	01(a)	Bar, HCl, HNO_3, HF	Batch	37.8	Pre-1900	Unk	Unk	12	Unk	Unk	12	None	Direct
	02	Bar, H_2SO_4, HNO_3, HF	Batch	20.4	Pre-1900	133.6	-	14	0	-	120	ARF	Direct
	03	Wire, H_2SO_4, HNO_3, HF	Batch	37.2	Pre-1900	Unk	Unk	113	Unk	Unk	113		Direct
0684V	01	Sheet, Strip, Plate, H_2SO_4 HNO_3, HF	Batch	193.5	1916	409	-	5	409	-	5	NA	NA
0724A	01(a)	Pipe, HNO_3, HF	Batch	75	1951	Unk	Unk	Unk	Unk	Unk	Unk	CNT, SSP, SL, NL, CT, PSP	Direct
0776C	*	*	*	*	*	*	*	*	*	*	*	*	*
0776F	01	Bar, Wire, H_2SO_4, HCl	Batch	25.5	1961	169	-	1.2	169	-	1.2	FLP, NC, FP,	Direct
0776G	01	Bar, Rod, Wire, HNO_3, Muriatic	Batch	5	1925(1950)	1050	-	18.7	1050	-	18.7	FDSP, FP, NC	Direct
0776H	01	Sheet, H_2SO_4, HNO_3	Batch	12.9	1902	3303	-	42.7	3303	-	42.7	CNT, NW, CL	Direct

TABLE III-3
COMBINATION ACID PICKLING, CONTINUOUS AND BATCH TYPE MILLS
SUMMARY TABLE
PAGE 7

Plant Code No.	Line No.	Process Product	Process Mode	Capacity (Tons/Day)	1st Year Production	Applied Flow (Gallons/ton)			Discharge Flow (Gallons/ton)			Treatment Components	Discharge Mode
						Rinses	Scrubber	Conc.	Rinses	Scrubber	Conc.		
0776J	01	Wire, HNO_3, HF, Muriatic	Batch	8.1	1975	360	Unk	-	360	Unk	-	CNT, NL	Direct
0792A	01(a)	Rod, Wire, H_2SO_4, HCl	Batch	54	1925	180	-	4	180	-	4	None	POTW
0796A	*	*	*	*	*	*	*	*	*	*	*	*	*
0856E	01	Sheet, Plate, HNO_3, HF	Batch	78	1957	922	-	123	922	-	123	CNT, NL, SL	Direct
0856H	01	Plate, HNO_3, HF	Batch	125.4	1968	338	39.4	13.4	338	39.4	13.4	CNT, NL, PSP, SSP, SS	Direct
0860B	01	Strip, H_2SO_4, HNO_3, HF	Cont.	390	1962(1957)	2585	738	14.8	2585	738	14.8	CNT, SS	Direct
0860F	01(a)	Wire, H_2SO_4, HCl	Cont.	45	1962	0	11,520	864	0	640	864	CNT, SSP, FP, SC, T, VF, NA, CT, DW	Direct
0884E	01	Tubes, HF, HNO_3	Batch	24	1968	[650]	[5400]	6.3	[650]	[10]	6.3	CNT, NL, PSP, E, FLP SSP	POTW
0884F	01	Tubes, HNO_3, HF	Batch	4.5	1970	<1	-	<1	0	-	<1	None	Direct
0900	01	HNO_3, HF	Cont.	182	Unk	[1888]	[157]	Unk	[917]	[157]	Unk	CR, NL, E, SS, CL, T, SC	
0948F	01(a)	Pipe, H_2SO_4, HNO_3	Cont.	81.9	1959	176	882	Unk	176	0	Unk	None	Direct

TABLE III-3
COMBINATION ACID PICKLING SUMMARY TABLE
PAGE 8

KEY TO ABBREVIATIONS

ARF : Recovery of Acid via Fume Filters
CSD : Centrifuge Sludge Dewatering
DC : Dechlorination (Sulfur Dioxide)
FIR : Ferrous Iron Removal by Air Sparging
FLFC : Flocculation with Ferric Chloride
FLW : Flocculation with Wastes
FLWPL : Flocculation with Waste Pickle Liquor
FP : Pressure Filtration
LS : Lamella Separator
NAL : Neutralization with Alum
NAM : Neutralization with Ammonia
NU : Neutralization with Unknown
NR : Not Reported
pHS : pH Stabilization
SAPT : Sent to Another Plant for Treatment
UNK : Unknown

* : Confidential Data
(a) : Carbon Steel Mill
[ ] : Number in brackets represents values received in the responses to the detailed questionnaires.

NOTE : See Table VII-1 for other general abbreviation.

TABLE III-4

BATCH SULFURIC ACID PICKLING DATA BASE

	No. of Operations	% of Total No. of Operations	Daily Capacity of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original study	8	4.7	3,625	7.9
Operations sampled for toxic pollutant study	8	4.7	2,256	4.9
Total number of operations sampled	16	9.4	5,881	12.8
Operations selected for the detailed DCP	17 incl. 3 above	10.0 incl 1.8 above	5,629 incl. 3,345 above	12.3 7.3
Operations sampled and/or solicited via detailed DCP	30	17.6	8,165	17.8
Operations responding to basic DCP	136	80.0	38,966	85.0
Estimated total number of batch sulfuric acid picklers	170	100.0	45,850	100.0

TABLE III-5

CONTINUOUS SULFURIC ACID PICKLING DATA BASE

	No. of Operations	% of Total No. of Operations	Daily Capacity of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original study	7	9.0	13,118	16.3
Operations sampled for toxic pollutant study	3	3.8	3,652	4.5
Total number of operations	10	12.8	16,760	20.8
Operations selected for the detailed DCP	1	1.3	127	0.2
Operations sampled and/or solicited via detailed DCP	11	14.1	16,887	20.9
Operations responding to basic DCP	55	70.5	68,604	85.0
Estimated total number of continuous sulfuric acid picklers	78	100.0	80,700	100.0

TABLE III-6

HYDROCHLORIC ACID PICKLING DATA BASE

	No. of Operations	% of Total No. of Operations	Daily Capacity of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original study	14*	10.4	19,110	16.3
Operations sampled for toxic pollutant study	9 incl. 2 above	7.8 incl. 1.7 above	6,864 1,197 above	5.9 incl. 1.0 above
Total number of operations sampled	20	17.4	24,777	21.2
Operations selected for the detailed DCP	13 incl. 2 above	11.3 incl. 1.7 above	14,785 incl. 2,196 aobve	12.6 incl. 1.9 above
Operations sampled and/or solicited via detailed DCP	31	27.0	37,366	31.9
Operations responding to basic DCP	98	85.2	100,155	85.5
Estimated total number of hydrochloric acid picklers	115	100	117,140	100

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*: Two of these plants are Canadian and will not be included in any percentage or capacity figures.

TABLE III-7

COMBINATION ACID PICKLING DATA BASE
BATCH TYPE OPERATIONS

	No. of Operations	% of Total No. of Operations	Daily Capacity of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original study	4	5.1	472.8	5.2
Operations sampled for toxic pollutant study	5	6.4	313.8	3.5
Total number of operations sampled	9	11.5	786.6	8.7
Operations selected for the detailed DCP	5 incl. 2 above	6.4 incl. 2.6 above	1,133.6* incl. 89.4 above	12.6 incl. 1.0 above
Operations sampled and/or solicited via detailed DCP	14	17.9	1,830.8	20.3
Operations responding to basic DCP	66	85	7,657*	85
Estimated total number of batch type combination acid picklers	78	100.0	9,008*	100.0

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*: Confidential mills' capacity not included in this total.

TABLE III-8

COMBINATION ACID PICKLING DATA BASE CONTINUOUS TYPE OPERATIONS

	No. of Operations	% of Total No. of Operations	Daily Capacity of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original study	4	5.4	503.1	4.5
Operations sampled for toxic pollutant study	1 incl. 1 above	1.4 1.4	183 incl. 183 above	1.6 incl. 1.6 above
Total number of operations sampled	4	5.4	503.1	4.5
Operations selected for the detailed DCP	0	0	0	0
Operations sampled and/or solicited via detailed DCP	4	5.4	503.1	4.5
Operations responding to basic DCP	63	85	9,557	85
Estimated number of continuous type combination acid picklers	74	100.0	11,243	100.0

TABLE III-9

SUMMARY OF SAMPLED OPERATIONS
ACID PICKLING OPERATIONS

SULFURIC ACID

Sample Code	Reference Code	Type of Operation	Process Product	Steel Type
I-2A	0856P	Batch	Rod and Wire	Carbon
I-2B	0856P	Batch	Rod and Wire	Carbon
O-2	0590	Batch	Wire	Carbon
P-2	0312	Batch	Bars, Shapes, and Tubing	Carbon
Q-2	0894	Batch	Rod and Wire	Carbon
R-2	0240B	Batch	Tube	Carbon
S-2	0256G	Batch	Pipe and Tube	Carbon
090	0476A	Batch	Pipe and Tube	Carbon
091	0612	Batch	Rod and Bar	Carbon
092	0088A	Batch	Pipe and Tube	Carbon
096	0112I	Batch	Fasteners and Special Shapes	Carbon
098	0684D	Batch	Bars, Rods and Special Shapes	Specialty
R	0240A	Batch	Billets and Bars	Specialty
H-2A	0432A	Continuous	Strip	Carbon
H-2B	0432A	Continuous	Strip	Carbon
QQ-2	0584E	Continuous	Sheet	Carbon
SS-2	0112A	Continuous	Sheet and Strip	Carbon
TT-2	0856D	Continuous	Strip	Carbon
WW-2	0868A	Continuous	Strip and Sheet	Carbon
T-2	0792B	Continuous	Strip	Carbon
094A	0948C	Continuous	Sheet	Carbon
094B	0948C	Continuous	Strip	Carbon
097	0760	Continuous	Strip	Carbon

TABLE III-9
SUMMARY OF SAMPLED OPERATIONS
ACID PICKLING OPERATIONS
PAGE 2

HYDROCHLORIC ACID

Sample Code	Reference Code	Type of Operation	Process Product	Steel Type
I-2	0856P	Continuous	Wire and Rod	Carbon
U-2	0480A	Batch	Rod	Carbon
V-2	0936	Batch	Rod and Wire	Carbon
W-2	*	Continuous	Strip	Carbon
X-2	0060B	Continuous	Strip	Carbon
Y-2	*	Continuous	Strip	Carbon
Z-2	0396D	Continuous	Strip	Carbon
AA-2	0384A	Continuous	Strip	Carbon
BB-2	0060	Continuous	Strip	Carbon
091	0612	Continuous	Wire	Carbon
093	0396D	Continuous	Strip	Carbon
095	0584F	Continuous	Strip	Carbon
099	0528B	Continuous	Strip	Carbon
100	0384A	Continuous	Strip	Carbon

COMBINATION ACID

Sample Code	Reference Code	Type of Operation	Process Product	Steel Type	Acids Used In Process
A(1)	0900	Continuous	Sheet and Strip	Specialty	HF/HNO_3
D	248B	Continuous	Strip	Specialty	H_2SO_4, HNO_3, HF
I	432K-02	Continuous	Sheet	Specialty	H_2SO_4, HNO_3, HF
O	176	Continuous	Strip	Specialty	Unk, HNO_3, HF
121(1)	0900	Continuous	Sheet and Strip	Specialty	HF/HNO_3
U	0748	Batch	Pipe and Tube	Specialty	Unk
123	88A	Batch	Tubes	Specialty	HNO_3, HF
124	88D	Batch	Tubes	Specialty	HNO_3/HF
C	424-01	Batch	Plate, Bar	Specialty	H_2SO_4, HNO_3/HF
F	856H	Batch	Plate	Specialty	H_2SO_4, HNO_3/HF
L	440A-01	Batch	Bar	Specialty	HCl, HNO_3
122	176	Batch	Rod, Wire, Shapes	Specialty	HCl, HNO_3, HNO_3/HF, HCl/HNO_3
125	884E	Batch	Tubes	Specialty	HF/HNO_3

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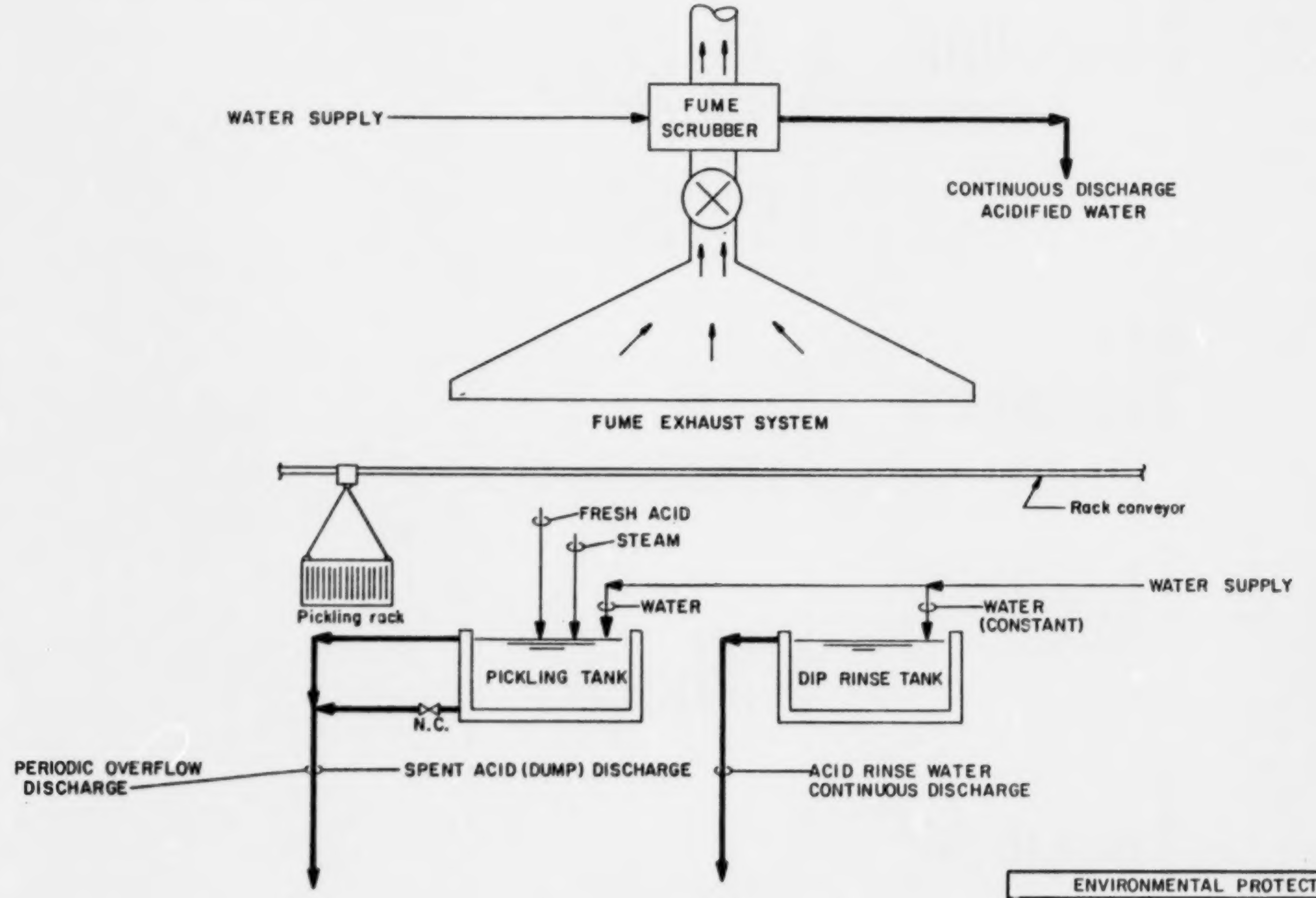
(1) Operations A and 121 are the same operation that was visited on two different occasions.

* Plants W-2 and Y-2 are located outside of the United States, and have not been assigned a reference code number.

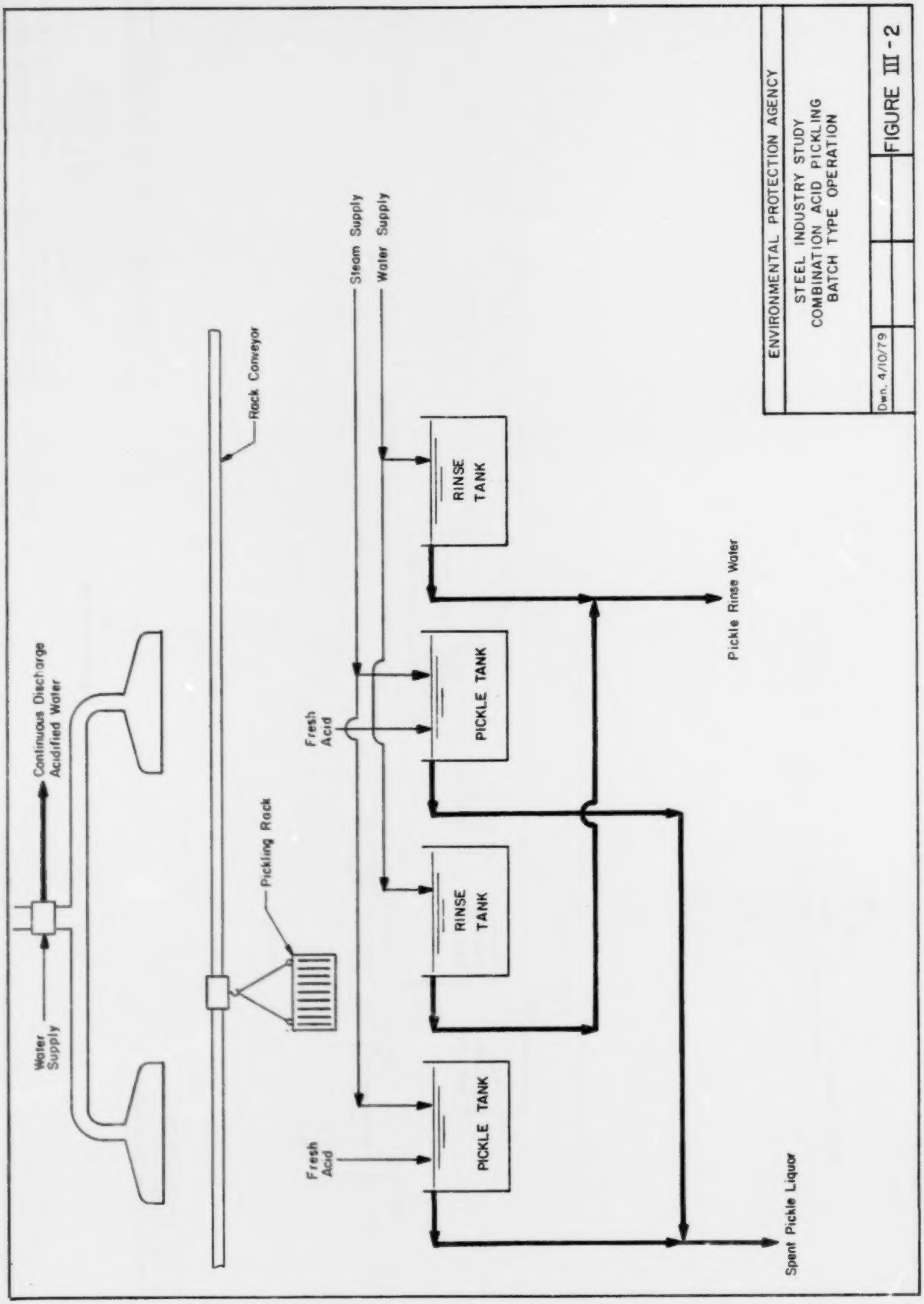


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
BATCH PICKLING
SULFURIC & HYDROCHLORIC ACID
PROCESS FLOW DIAGRAM

Dwn. 3/27/79

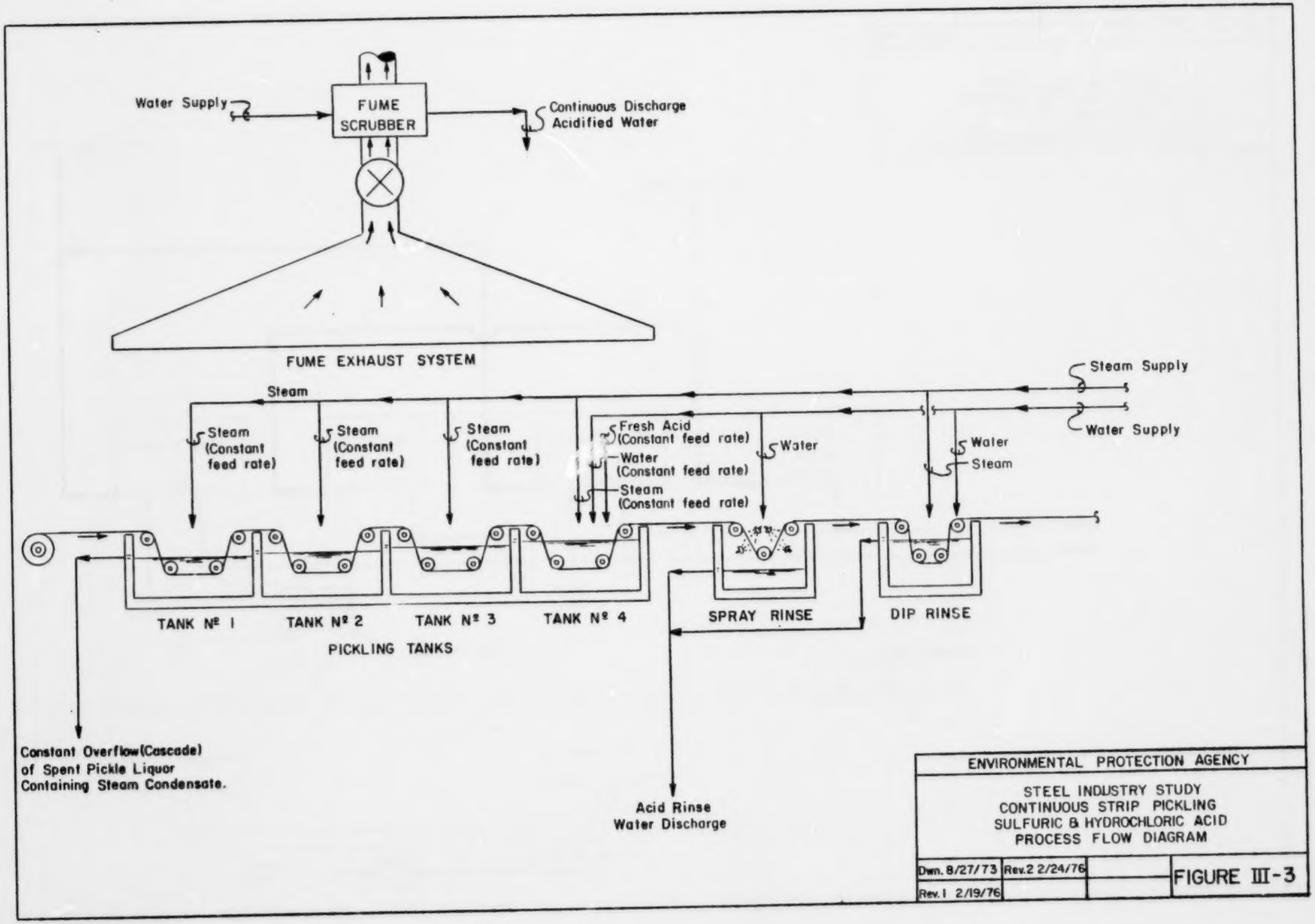
FIGURE III-1



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
BATCH TYPE OPERATION

FIGURE III - 2

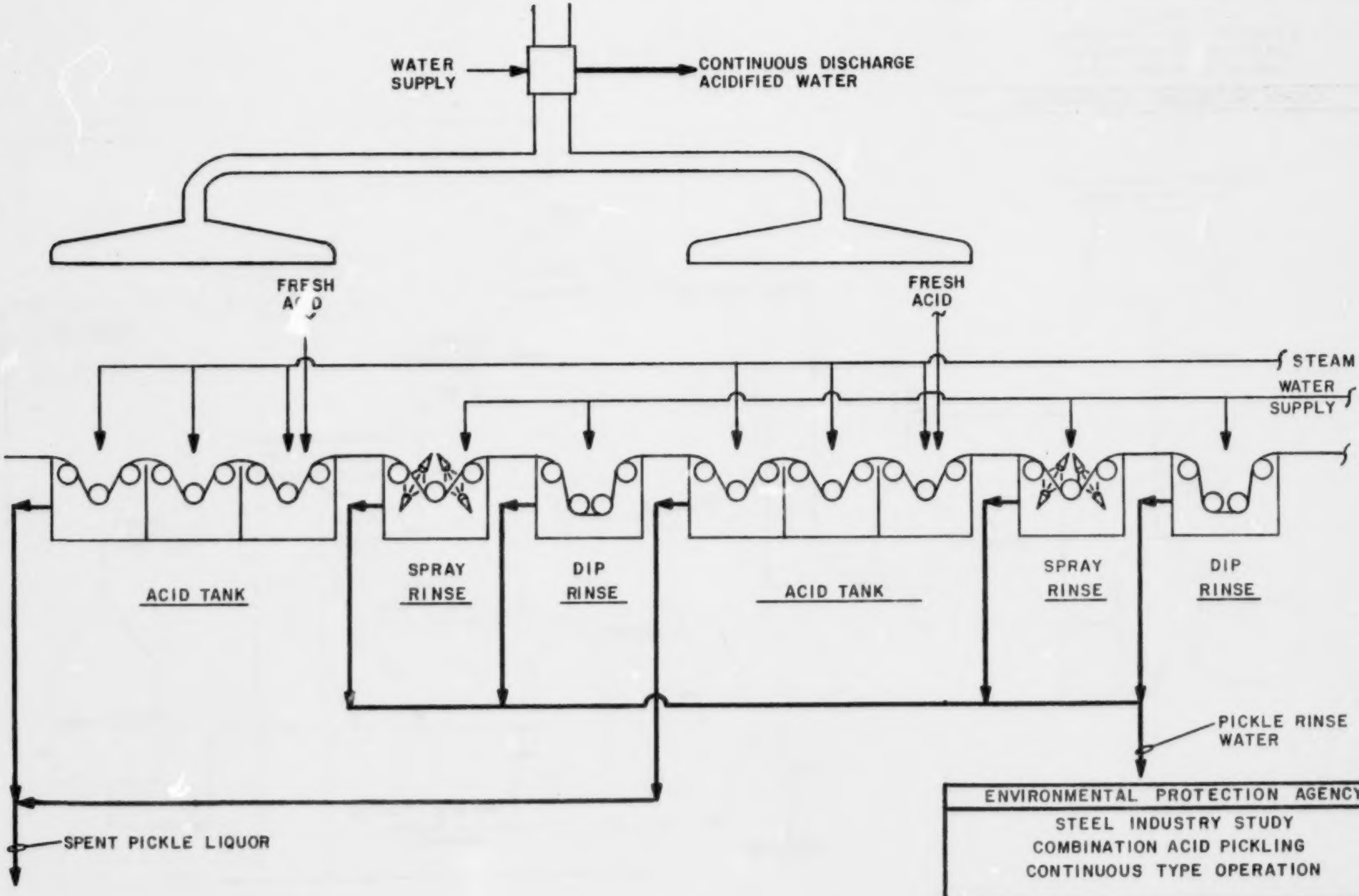

Water Supply
FUME SCRUBBER
Continuous Discharge Acidified Water
FUME EXHAUST SYSTEM
Steam Supply
Steam
Water Supply
Steam (Constant feed rate)
Steam (Constant feed rate)
Steam (Constant feed rate)
Fresh Acid (Constant feed rate)
Water (Constant feed rate)
Steam (Constant feed rate)
Water
Water
Steam
TANK Nº 1
TANK Nº 2
TANK Nº 3
TANK Nº 4
PICKLING TANKS
SPRAY RINSE
DIP RINSE
Constant Overflow (Cascade) of Spent Pickle Liquor Containing Steam Condensate.
Acid Rinse Water Discharge

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
CONTINUOUS STRIP PICKLING
SULFURIC & HYDROCHLORIC ACID
PROCESS FLOW DIAGRAM

Dwn. 8/27/73 Rev.2 2/24/76
Rev.1 2/19/76

FIGURE III-3

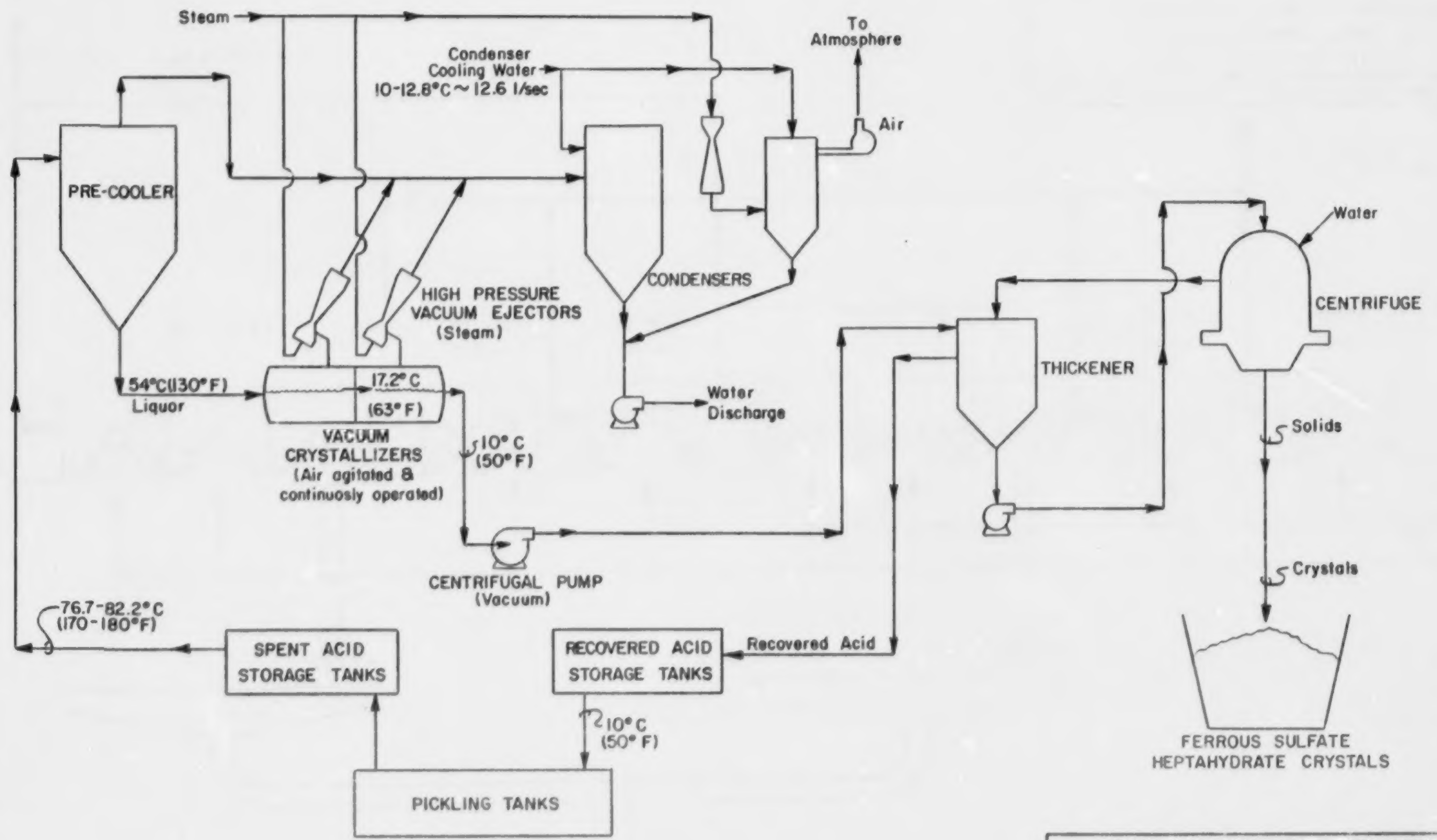


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
CONTINUOUS TYPE OPERATION

Dwn.4/10/79

FIGURE III-4

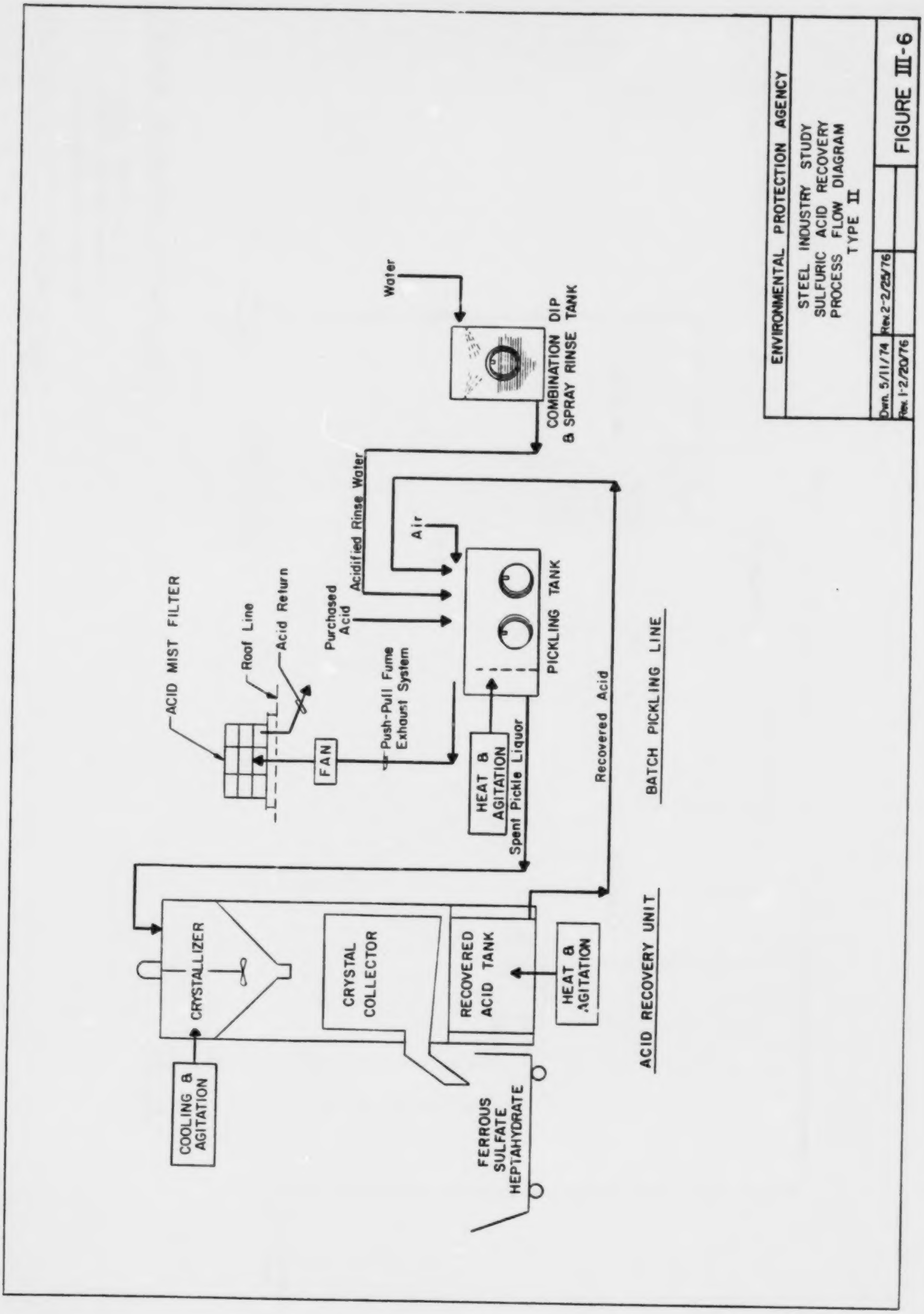


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SULFURIC ACID RECOVERY
PROCESS FLOW DIAGRAM
TYPE I

Dwn. 5/13/74 Rev.2-2/26/76
Rev. 1-2/20/76

FIGURE III-5

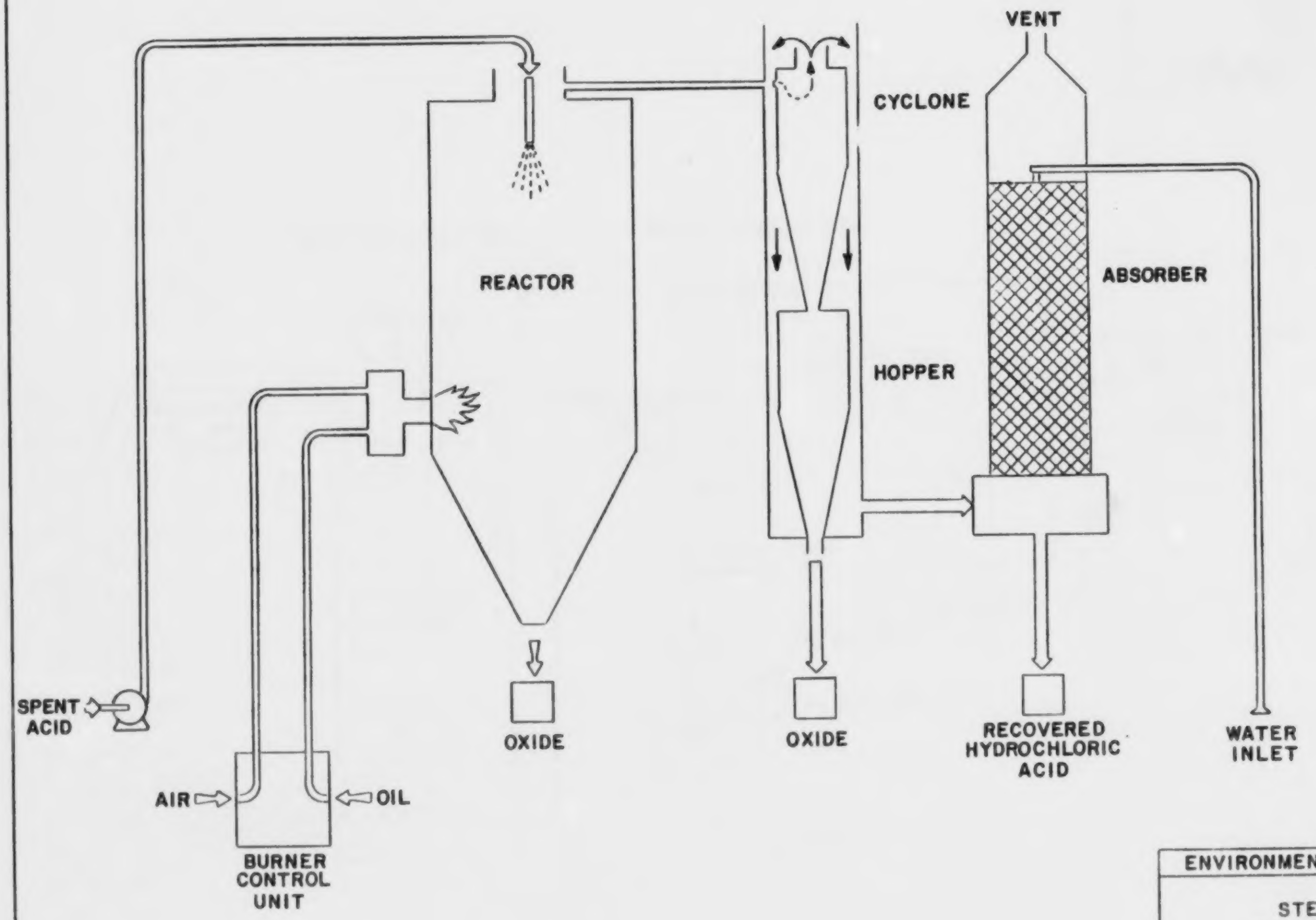


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SULFURIC ACID RECOVERY
PROCESS FLOW DIAGRAM
TYPE II

Dwn. 5/11/74
Rev. 1-2/20/76
Rev. 2-2/25/76

FIGURE III-6

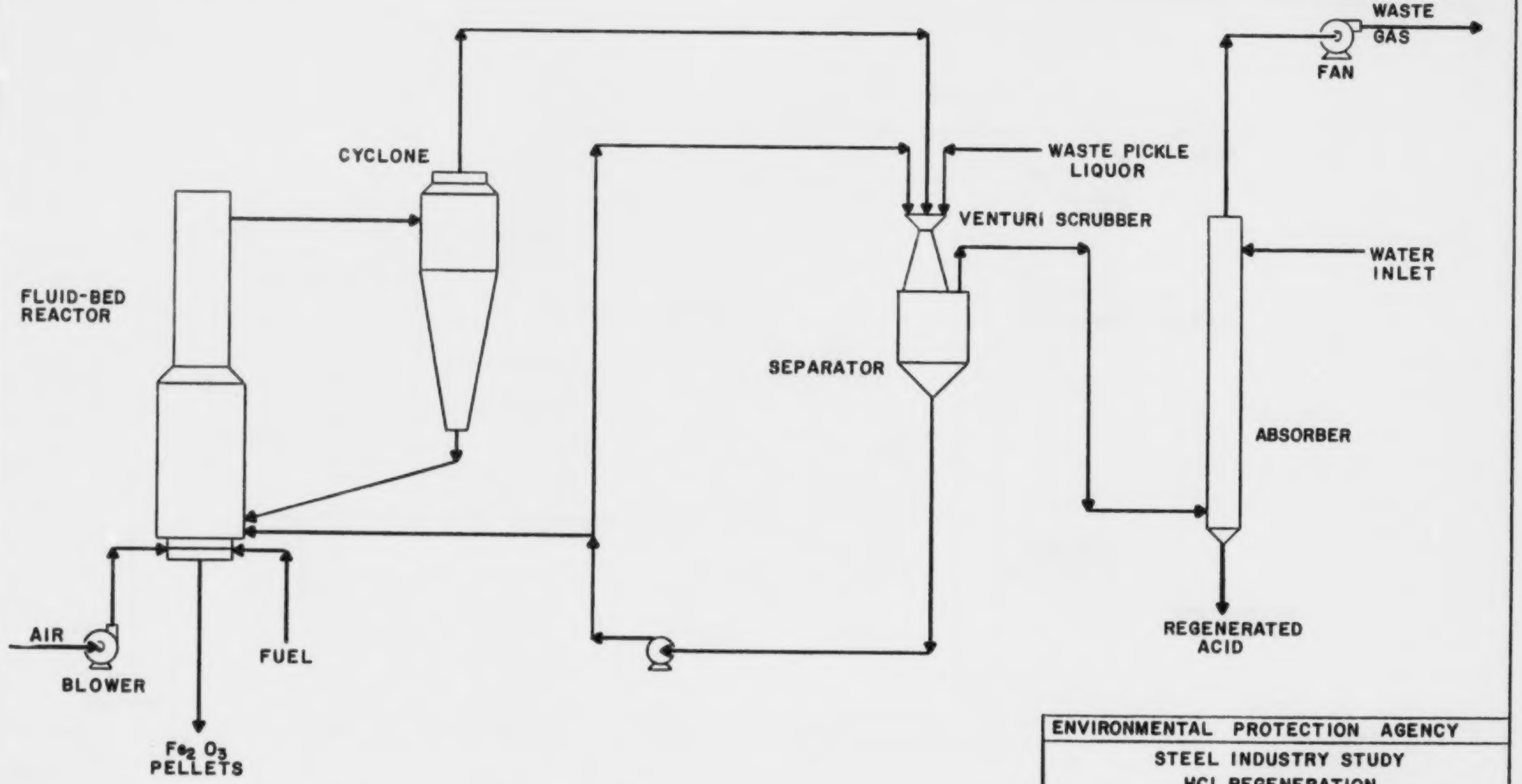


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCl REGENERATION TYPE I
PROCESS FLOW DIAGRAM

Dwg. 5/4/74 Rev. 2/26/76
Rev. 2/20/76

FIGURE III-7

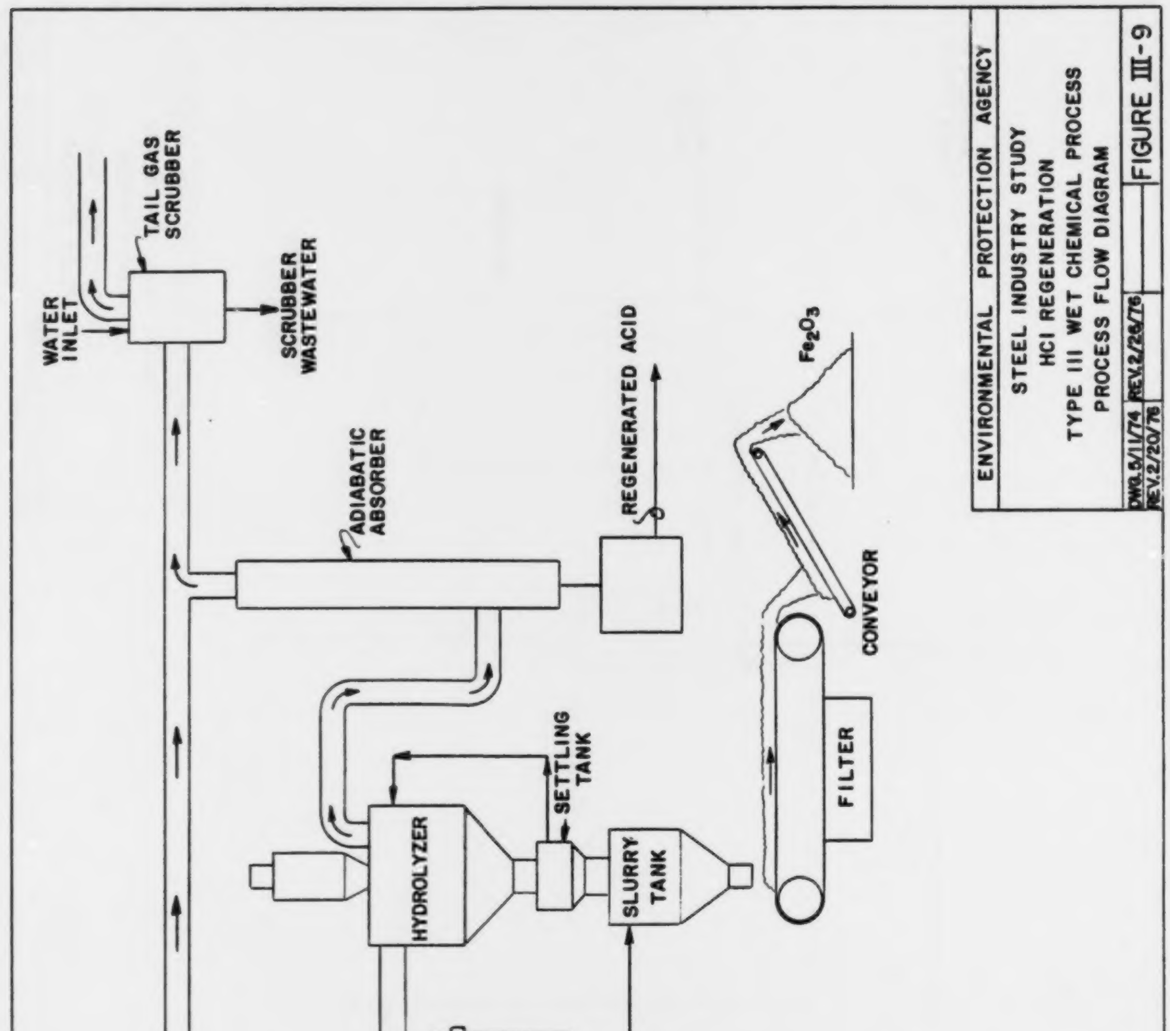


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCl REGENERATION
TYPE II FLUID BED ROASTER
PROCESS FLOW DIAGRAM

Dwg.5/4/74 Rev.2/26/76
Rev.2/20/76

FIGURE III-8



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCl REGENERATION
TYPE III WET CHEMICAL PROCESS
PROCESS FLOW DIAGRAM

FIGURE III-9

ACID PICKLING SUBCATEGORY

SECTION IV

SUBCATEGORIZATION

The Agency considered several factors to determine whether further subdivision of the pickling process is appropriate. The applicability of these factors to the pickling process and the rationale for the proposed subdivision of the acid pickling subcategory are presented below.

In the originally promulgated regulation, the Agency subdivided the pickling process into three subgroups. That division has been retained. However, each subdivision has been segmented further, as shown below.

Segmentation (1976 Regulations)	Revised Segmentation
Sulfuric Acid	Sulfuric Acid
a. Batch Operations - Acid Recovery b. Continuous Operations - Neutralization c. Continuous Operations - Acid Recovery	a. Batch Operations - Neutralization b. Batch Operations - Acid Recovery c. Continuous Operations - Neutralization d. Continuous Operations - Acid Recovery
Hydrochloric Acid	Hydrochloric Acid
a. Neutralization b. Acid Regeneration	a. Batch Operations - Neutralization b. Continuous Operations - Neutralization c. Continuous Operations - Acid Regeneration
Combination Acid	Combination Acid
a. Batch Operations - Pipe and Tube b. Batch Operations - Other c. Continuous Operations	a. Batch Operations b. Continuous Operations

For all acid pickling operations, one common element which affects the segmentation of the process is the type of pickling carried out (i.e., whether the operation is batch or continuous). Because of the different operating practices and products processed by these two operations, applied and discharge flow rates are different.

The treatability of the wastewater generated in the sulfuric acid and hydrochloric acid subdivisions also affects segmentation. Acid recovery processes make zero discharge from sulfuric acid pickling operations possible, while neutralization of wastewaters and acid regeneration of hydrochloric acid still require a discharge of wastewater pollutants. Therefore, further segmentation is needed to accommodate the treatment options.

The Agency also examined other elements, but found that the discharge flow rate was the only other element which has a significant effect upon segmentation. The Agency analyzed line age and size to determine if those factors had an effect upon wastewater quality or quantity, but found no signficant relationship. Also, the Agency considered such factors as product type, raw material, and wastewater characteristics, but found that none of these factors warrant further subdivision or segmentation. While water use was found to have an effect upon specific effluent limitations, this variation did not require further segmentation. Each of these elements is discussed in greater detail below.

Factors Considered in Subdivision and Segmentation

Manufacturing Process and Equipment

Within the acid pickling subcategory, the processes employed and the equipment used are basically the same throughout the industry. The Agency found only two signficant differences in acid pickling operations that could possibly affect subdivision. The first involves the manner in which the pickling process is carried out. While some operations pickle products in a batch fashion, other operations use a continuous process to pickle products such as strip or sheet, resulting in significantly different flow rates. The justification for segmentation based on the batch or continuous mode of operation is discussed below under the heading "Process Water Usage."

The second difference is in equipment employed at acid pickling operations. Fume scrubber systems which collect and scrub the fumes generated in the pickling process are used at some lines. Most types of scrubbers generate considerable quantities of wastewater and consequently increase the pollutant load in the discharge from the pickling process. The proposed BAT, NSPS, PSES, and PSNS limitations and standards have been developed based upon the assumption that all acid pickling operations use fume scrubbers.

Final Products

An analysis was done to determine whether the products being processed affected the pickling process, wastewater characteristics, or other significant factors. For this analysis, the Agency evaluated only rinsewater quality, since rinsewater is the only wastewater source, which could significantly be affected by variations in the product and, thereby, affect segmentation. The spent pickle liquor and fume scrubber characteristics are relatively constant for each subdivision, even for operations which process a wide variety of products.

A. Sulfuric Acid Pickling Operations

Sulfuric acid pickling operations process a wide variety of products, some as final products and others for further processing (i.e., cold reduction, coating, oiling, or painting). The most common steel shapes processed by sulfuric acid pickling are: strip/sheet/plate; bar/wire/rod; and pipe/tube. The strip/sheet/plate grouping comprises 92.5% of the continuous sulfuric acid pickling operations, while the bar/wire/rod and pipe/tube groups make up 92.5% of all batch operations.

Sampling data do not indicate any significant differences in rinsewater characteristics between the three types of products being pickled in sulfuric acid solutions. In addition, the basic pickling process is similar for these configurations. Therefore, the Agency believes that no further segmentation of this subdivision is warranted on the basis of final products.

B. Hydrochloric Acid Pickling

The most common steel products processed by hydrochloric acid pickling are: strip/sheet; pipe/tube; and wire/rod/fence. Strip/sheet may, in turn, be formed into various shapes, such as auto parts, architectural components, containers, gutters, and channels. The seven batch hydrochloric acid picklers in operation process all three types of product groupings. The continuous hydrochloric acid pickling segment consists of the strip/sheet and wire/rod/fence product lines.

Sampling data do not indicate any significant differences in the qualities of the rinsewaters generated for the three types of products. In addition, the basic pickling process is similar for these configurations. Therefore, the Agency believes that no further segmentation of the hydrochloric acid subdivision is warranted on the basis of final products.

C. Combination Acid Pickling

As in the other subdivisions, the products processed in combination acid pickling operations are strip/sheet, pipe/tube, and bar/wire products. Strip/sheet products comprise 92.4% of the continuous operations. In contrast, batch operations consist mainly of bar/wire and pipe/tube products (81.3%). As in the other two acid pickling subdivisions, no significant differences were found in either the rinsewater quality or pickling process characteristics associated with the pickling of the three types of products. Therefore, the Agency believes that no further segmentation on the basis of final products is warranted in the combination acid pickling subdivision.

Raw Materials

A. Type of Acid Used

The most signficant raw material - the acid used for pickling - forms the basis for subdividing the pickling subcategory into sulfuric, hydrochloric, and combination acid subdivisions. The choice of the acid(s) to be used in the process is usually dictated by the types of steel to be pickled and the desired surface characteristics after pickling. Sulfuric acid penetrates the oxide layer and reacts with the base metal to form hydrogen, which aids in removing the oxide scale. The scale eventually dissolves in the acid bath forming ferrous sulfate. Hydrochloric acid reacts directly with the oxide scale, forming soluble ferrous and ferric chloride. Generally, combination acid pickling is the preferred process for alloy, stainless, and other specialty steels. In addition to the iron salts which result from pickling, other metals found in the steel are dissolved in the acid bath. These are discussed in Section VI.

B. Type of Steel Pickled

The other significant raw materials are the carbon steel and specialty steel products being pickled. For the sake of this discussion, any operation which processes 50% or more carbon steel is called a "carbon steel operation", and any which processes less than 50% carbon steel is called a "specialty steel" operation. While the Agency found that the type of steel being processed might affect the way in which a pickling line is operated, it also found that the type of steel does not significantly affect the eventual wastewater pickling quantity. About 5.2% of the sulfuric acid pickling operations and only 2.9% of the hydrochloric acid operations pickle specialty steel products. While raw wastewaters from pickling specialty steels contain more toxic metal pollutants than do wastewaters from pickling carbon steel, nearly all specialty steels undergo combination acid pickling. Thus, the difference in wastewater quality between carbon and specialty steels is accounted for by the basic subdivision of the acid pickling subcategory into sulfuric, hydrochloric, and combination acid subdivisions. For these reasons, the Agency concluded that it is not necessary to segment or subdivide further, based upon the type of raw material used (i.e., the type of steel processed).

The type of steel pickled is often the determining factor for the types of acids used. For specialty steel operations, a much broader range of acids is used (hydrochloric, sulfuric, nitric, and hydrofluoric acids). Although the exact order of pickling and the types of acids used vary from plant to plant, most operations use hydrochloric or sulfuric acids at the head of the pickling lines and finish with a mixture of nitric and hydrofluoric acids.

Most carbon steel operations use hydrochloric and sulfuric acid pickling lines. Nitric acid is used at one carbon steel line, and hydrofluoric acid is not used at any line processing carbon steel. Hence, the high levels of fluorides and nitrates found in the discharges from specialty steel operations are not found in discharges from carbon steel lines. This was taken into consideration by the Agency in developing the proposed limitations.

The Agency also analyzed the effect of raw materials on applied and discharge flow rates. The Agency initially thought that specialty steel operations might require additional water in the process because of the more stringent product quality requirements. However, this did not turn out to be the case.

Wastewater Characteristics

As noted above, wastewaters from acid pickling operations originate from rinsewater, fume scrubbers, and spent acid solutions. Rinsewater flow is often the highest flow among the three sources and contains suspended solids and dissolved metals, and normally has a very low pH. Fume scrubber wastewaters are similar to rinsewaters in character. Flow rates through the scrubbers vary considerably, but discharge flows can be reduced to 10-50 gals/ton of steel processed if recycle is practiced. Fume scrubber blowdowns from sulfuric and hydrochloric acid pickling operations may be completely reused as makeup to cascade rinse systems. The third source, the spent pickle liquor (SPL) is lower in volume than the other sources but is highly contaminated. Because of the small volume and high pollutant levels, this waste is often hauled off-site for disposal. As would be expected, the wastewater characteristics of the combined discharge from pickling lines depends greatly on whether or not fume hood scrubbers are installed and whether or not the SPL is hauled off-site.

Another factor affecting wastewater characteristics is the type of acid used in the pickling process. As noted earlier, various acid combinations are used depending on the type of product being processed and the type of finish desired. The number of acids used ranges from one to four.

Wastewaters from each pickling subdivision can be treated by neutralization and settling. However, the materials remaining in solution are different for each subdivision. Sulfuric acid will form relatively insoluble calcium sulfate precipitates which contribute significantly to the sludge loads, while hydrochloric acid yields soluble calcium chlorides with less of an impact on sludge generation. Dissolved solids are likely to be higher for hydrochloric acid wastewaters after treatment with lime, soda ash, or caustic soda.

Fluorides are only discharged in significant quantities when hydrofluoric acids are used. Accordingly, allowances have been made in the proposed limitations for the use of hydrofluoric acid. The variations in waste character are the primary reasons for the division of pickling operations by acid type.

Wastewater Treatability

The Agency analyzed the treatability of wastewaters from the different acid pickling operations. Based upon the data developed during plant visits and the data supplied in DCP responses pertaining to treatment systems, the only signficant differences in wastewater treatability for acid pickling operations are in the sulfuric and hydrochloric pickling subdivisions, where acid recovery, regeneration, and neutralization are practiced. Because these methods differ significantly in discharge flow rates, pollutant loads, and typical treatment systems, the Agency concluded that segmentation on this basis is appropriate.

Size and Age

The Agency evaluated whether either the size or age of pickling operations are signficant factors which warrant further subdivision or segmentation of the acid pickling subcategory.

Figures IV-1 and IV-2 are plots of applied rinsewater flow (gal/ton), vs. production (tons/year) for sulfuric acid batch and continuous operations, respectively. The points on these plots are widely scattered, indicating no correlation between size and applied rinsewater flow, which is a major factor in pickling treatment system design. Figures IV-3 to IV-5, and Figures IV-6 and IV-7 present similar data for the hydrochloric acid and combination acid pickling subdivisions, respectively. Those data again demonstrate no correlation between size and applied rinsewater flow. Hence, there is no basis to further subdivide or segment pickling operations on the basis of size.

The question of age was addressed in two ways. First, plots of applied rinsewater flow (gal/ton) vs. age (first year of production) similar to those noted above were made. These data (Figures IV-8 to IV-14) show no correlation between the age of any type of pickling operation and the respective applied rinsewater flows. Secondly, the ability, ease, and cost of retrofitting pollution control facilities was evaluated. Table IV-1 lists the older pickling operations which have been retrofitted with pollution control facilities. The fact that treatment facilities have been retrofitted on those older lines, and that similar effluent loads are discharged from these treatment facilities, demonstrates the feasibility of retrofitting pollution control equipment to plants of all ages. As part of its data gathering efforts, the Agency also obtained actual costs incurred by the industry to install retrofitted treatment facilities, specifically including any costs due solely to retrofitting. In general, the industry reported either no specific retrofit costs or relatively small retrofit costs. Retrofit costs of about 14% of total treatment system costs were reported for one sulfuric acid pickling line. Based upon these data, the Agency concludes that the costs of retrofitting pollution control facilities on pickling lines are not substantial, and that no further subdivision or segmentation of the acid pickling subcategory on the basis of age is necessary.

Geographic Location

An examination of the raw waste characteristics, process water, application rates, discharge rates, effluent quality, and other factors relating to plant location revealed no general relationship or pattern. Sulfuric acid pickling operations are located in 20 states. Hydrochloric acid operations are in 13 states, and combination acid pickling operations are in 15 states. Most of these lines are located in the major steel producing areas of Pennsylvania and Ohio. Table IV-2 is a summary of the location of all acid pickling operations responding to the DCPs.

A small percentage of pickling plants are located in what could be considered "semi-arid" or "arid" regions. However, since no cooling systems are required to attain the proposed limitations and standards, consumption of water by these operations will be nil. Additional details on this issue are presented in Section VIII.

Process Water Usage

Table IV-3 presents average applied rinsewater flow rates for all batch and continuous pickling operations. The data presented in this table illustrate the basic differences between batch and continuous operations within each subdivision. Also presented in Table IV-3 are spent pickle liquor and fume scrubber flows. Both applied and discharge flows are presented for fume scrubbers to demonstrate the extent of recycle applied to these waters.

Based upon these data, the Agency decided to retain allowances for spent pickle liquor for sulfuric acid pickling and for fume scrubbers for hydrochloric acid pickling at the BPT level, and to incorporate all of these flows at the BAT level.

TABLE IV-1

ACID PICKLING OPERATIONS DEMONSTRATING THE ABILITY TO RETROFIT POLLUTION CONTROL EQUIPMENT

Subcategory	Reference Code	Operation Age (Year)	Treatment Age (Year)
Sulfuric Acid Pickling	0020B	1954	1974
	0048F	1944	1969
	0060D	1957	1968
	0060M	1970	1977
	0088A	1936	1969
	0088D	1962	1971
	0112	1922	1977
	0112C	1926	1977
	0256F	1953	1975
	0384A	1958	1964
	And Others		
Hydrochloric Acid Pickling	0020C	1946	1977
	0112B	1936	1971
	0176	1961	1956
	0320	1936	1955
	0384A	1932	1970
	0396D	1967	1969
	0432C	1952	1964
	0448A	1954	1970
	0580A	1962	1967
	And Others		
Combination Acid Pickling	0020B	1947	1974
	0088A	1952	1969
	0112A	1926	1977
	0112H	1940	1951
	0256F	1953	1975
	0284A	1957	1971
	0584D	1940	1970
	0860F	1962	1977
	And Others		

TABLE IV-2

LOCATION OF ACID PICKLING OPERATIONS

SULFURIC ACID PICKLING

Location	Total Numbers	% of Total
Pennsylvania	52	27.2
Ohio	36	18.8
Illinois	17	8.9
Indiana	14	7.3
Maryland	14	7.3
California	11	5.8
Connecticut	8	4.2
Michigan	8	4.2
Texas	7	3.7
Alabama	6	3.1
New York	4	2.1
Missouri	3	1.6
Washington	3	1.6
Kentucky	2	1.0
Georgia	1	0.5
Colorado	1	0.5
Florida	1	0.5
Mississippi	1	0.5
New Jersey	1	0.5
West Virginia	1	0.5
Number of States = 20	191	100%

HYDROCHLORIC ACID PICKLING

Location	Total Numbers	% of Total
Ohio	16	16.3
Pennsylvania	14	14.3
Michigan	14	14.3
Illinois	13	13.3
California	8	8.2
Kentucky	7	7.1
Indiana	7	7.1
Alabama	5	5.1
West Virginia	3	3.1
New Jersey	3	3.1
Georgia	3	3.1
New York	3	3.1
Connecticut	2	2.0
Number of States = 13	98	100%

TABLE IV-2
LOCATION OF ACID PICKLING OPERATIONS
PAGE 2

COMBINATION ACID PICKLING

Location	Total Numbers	% of Total
Pennsylvania	69	53.5
Ohio	18	14.0
Wisconsin	7	5.4
Maryland	6	4.7
New York	4	3.1
Indiana	4	3.1
California	4	3.1
Massachusetts	3	2.2
Illinois	3	2.2
Delaware	2	1.6
Texas	2	1.6
New Jersey	2	1.6
Georgia	2	1.6
Michigan	2	1.6
Florida	1	0.8
Number of States = 15	129	100%

TABLE IV-3

AVERAGE PROCESS FLOW VALUES (GAL/TON)-ACID PICKLING SUBCATEGORY

	Applied Spent Pickle Liquor	Applied Rinse	Applied Fume Hood Scrubber	Discharged Fume Hood Scrubber
Sulfuric Acid Pickling				
Batch Neutralization	15.6	327	708	10.3
Batch Acid Recovery	15.6	327	708	10.3
Continuous Neutralization	19.9	213	126	0
Continuous Acid Recovery	19.9	213	126	0
Hydrochloric Acid Pickling				
Batch Neutralization	7.2	538	150	0
Continuous Neutralization	8.4	295	176	6.2
Continuous Acid Regeneration	8.4	295	176	6.2
Combination Acid Pickling				
Batch	14.1	517	1136	2.0
Continuous	14.2	1809	716	47.8

These flow values represent averages of the best flow values.

FIGURE IV - 1

SULFURIC ACID PICKLING - BATCH
APPLIED RINSE FLOW (GAL/TON)
vs. PRODUCTION (TONS/TURN)

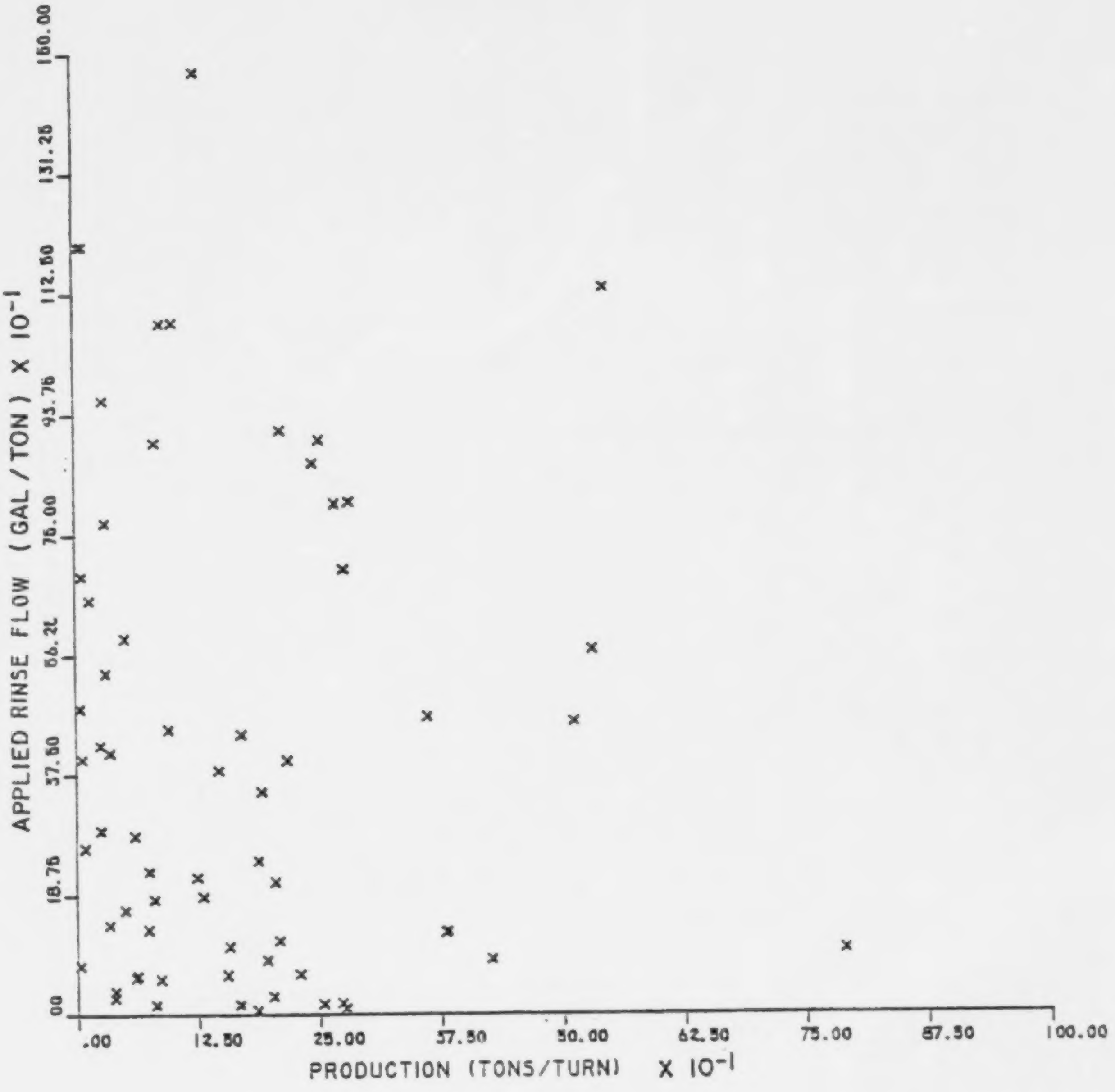


FIGURE IV- 2

SULFURIC ACID PICKLING - CONTINUOUS
APPLIED RINSE FLOW (GAL /TON)
vs. PRODUCTION (TONS/TURN)

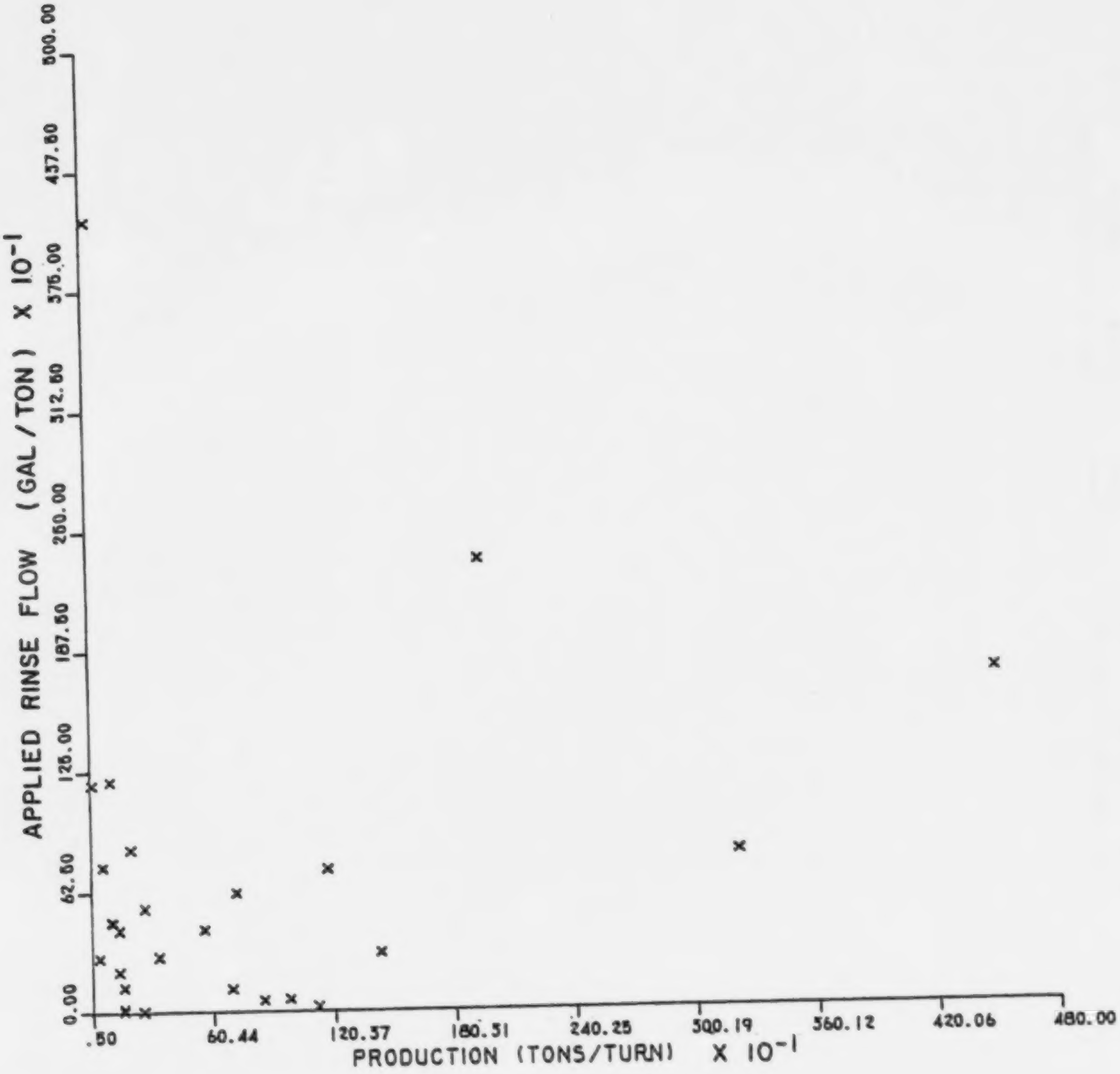


FIGURE IV - 3

HYDROCHLORIC ACID PICKLING - BATCH
APPLIED RINSE FLOW (GAL/TON)
vs. PRODUCTION (TONS/TURN)

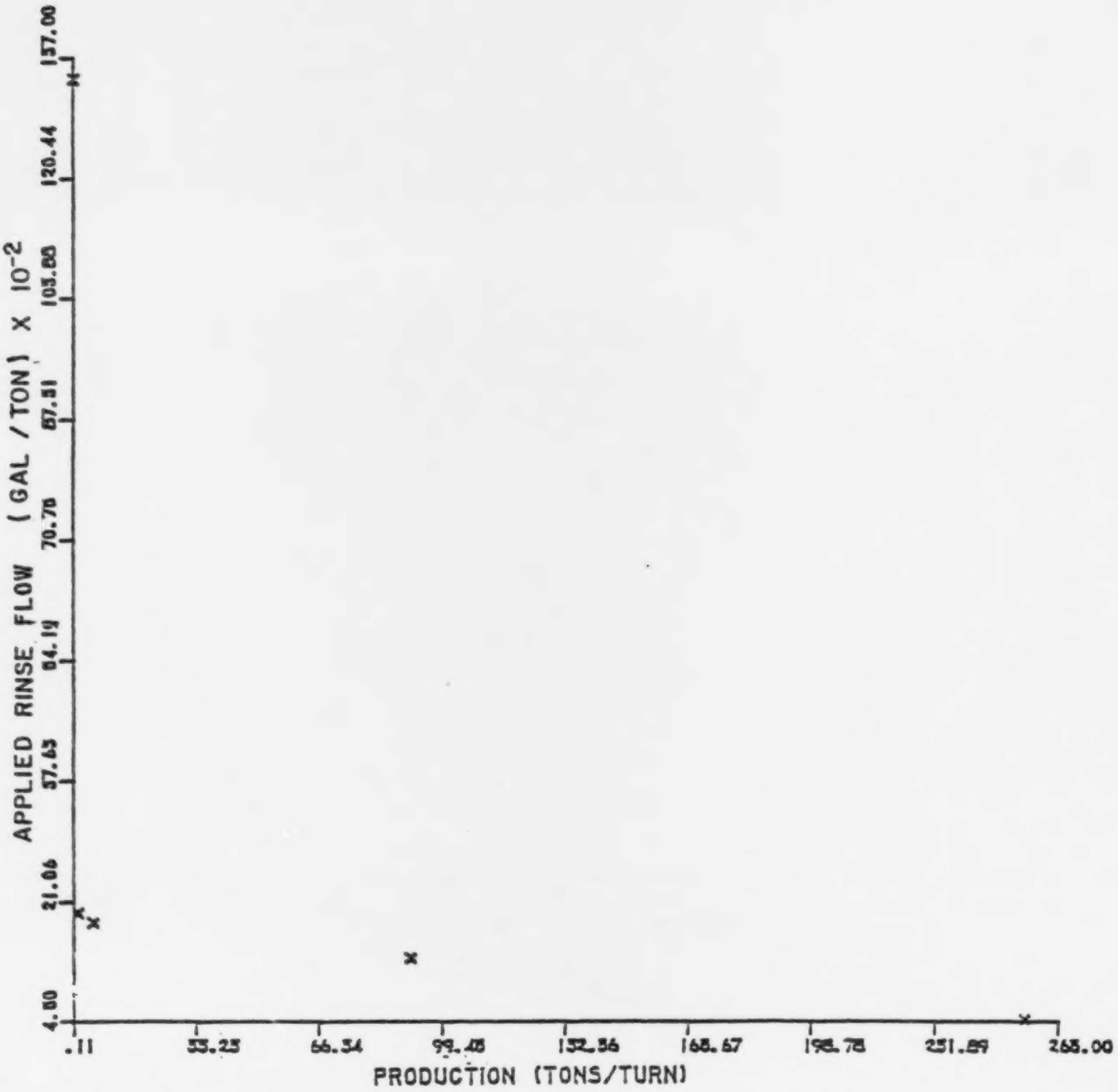


FIGURE IV- 4

HYDROCHLORIC ACID PICKLING - CONTINUOUS
APPLIED RINSE FLOW (GAL./TON)
vs. PRODUCTION (TONS/TURN)

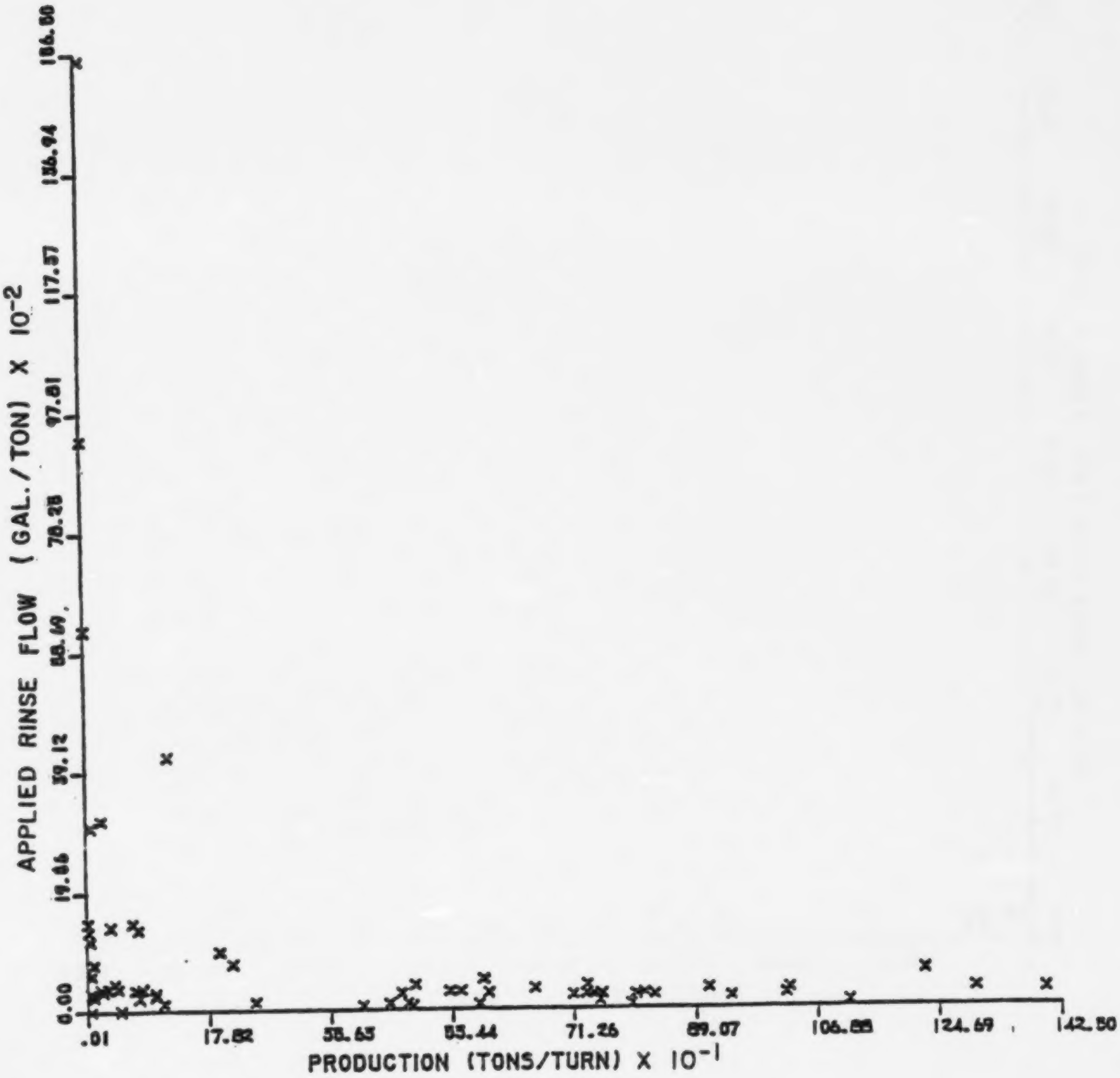


FIGURE IV - 5

HYDROCHLORIC ACID PICKLING - ALL PLANTS

APPLIED RINSE FLOW (GAL./TON)

vs. PRODUCTION (TONS/TURN)

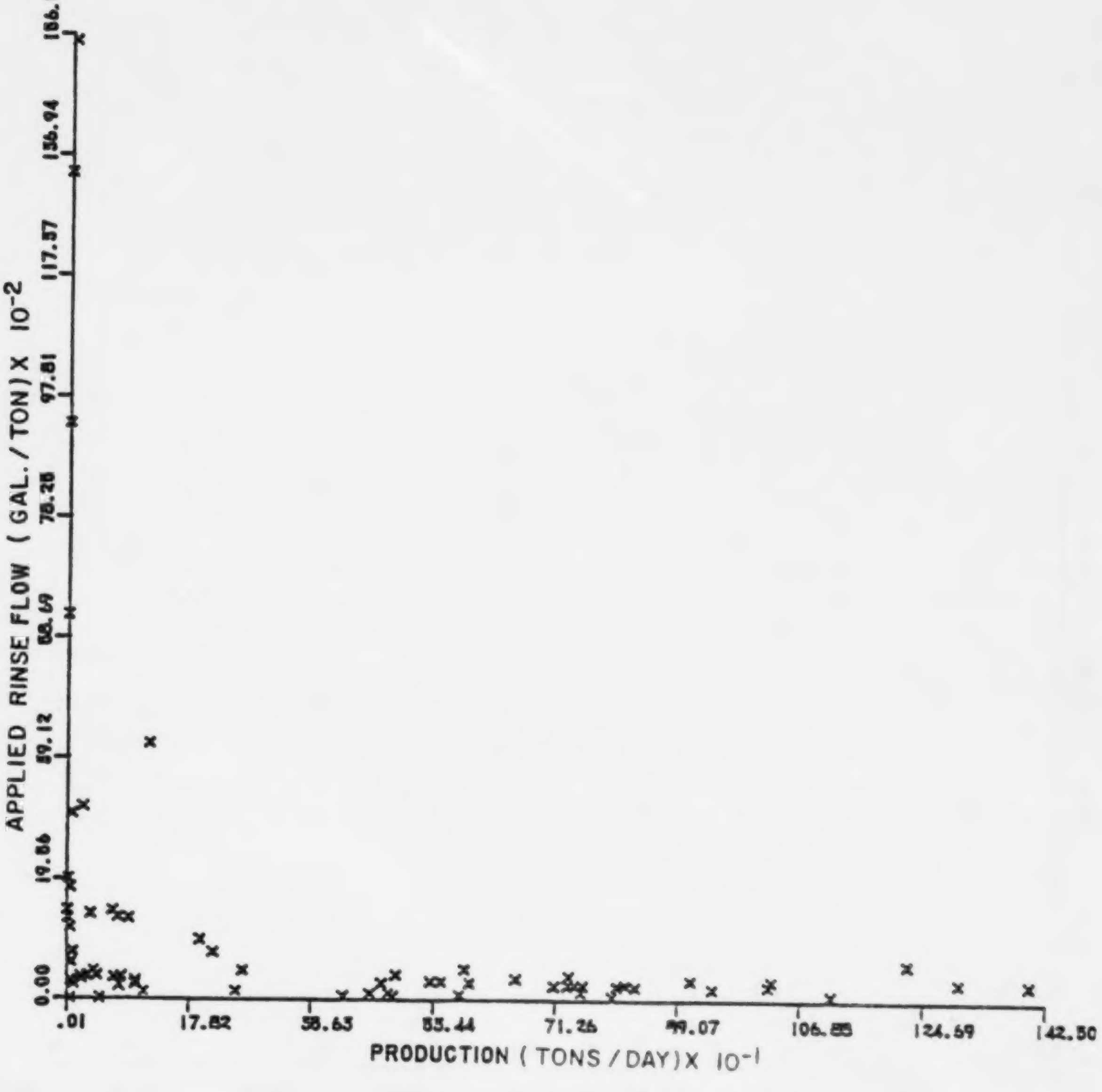


FIGURE IV - 6

COMBINATION ACID PICKLING - BATCH

APPLIED RINSE FLOW (GAL /TON)

vs. PRODUCTION (TONS/TURN)

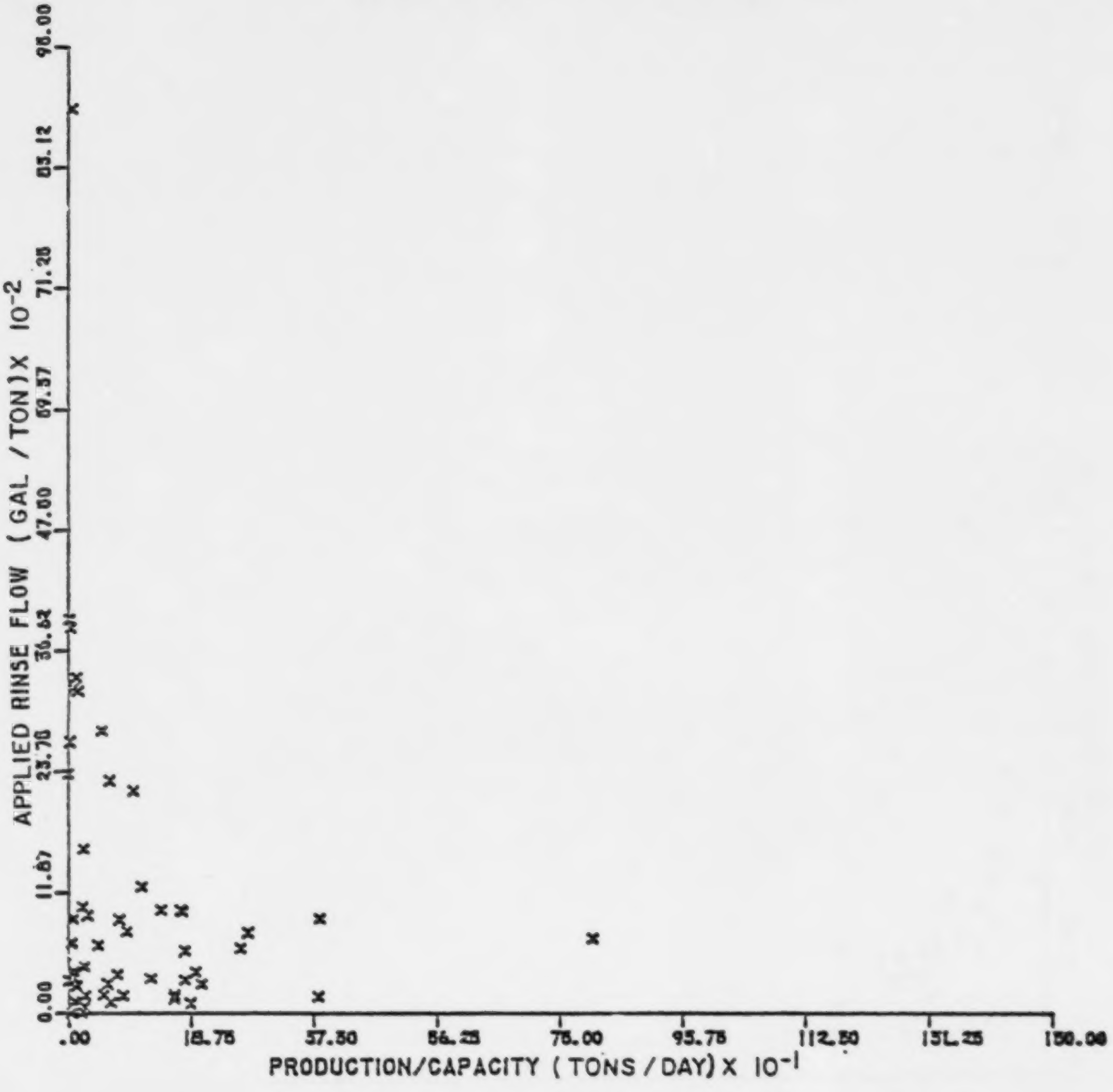


FIGURE IV - 7

COMBINATION ACID PICKLING - CONTINUOUS
APPLIED RINSE FLOW (GAL/TON)
vs. PRODUCTION (TONS/TURN)

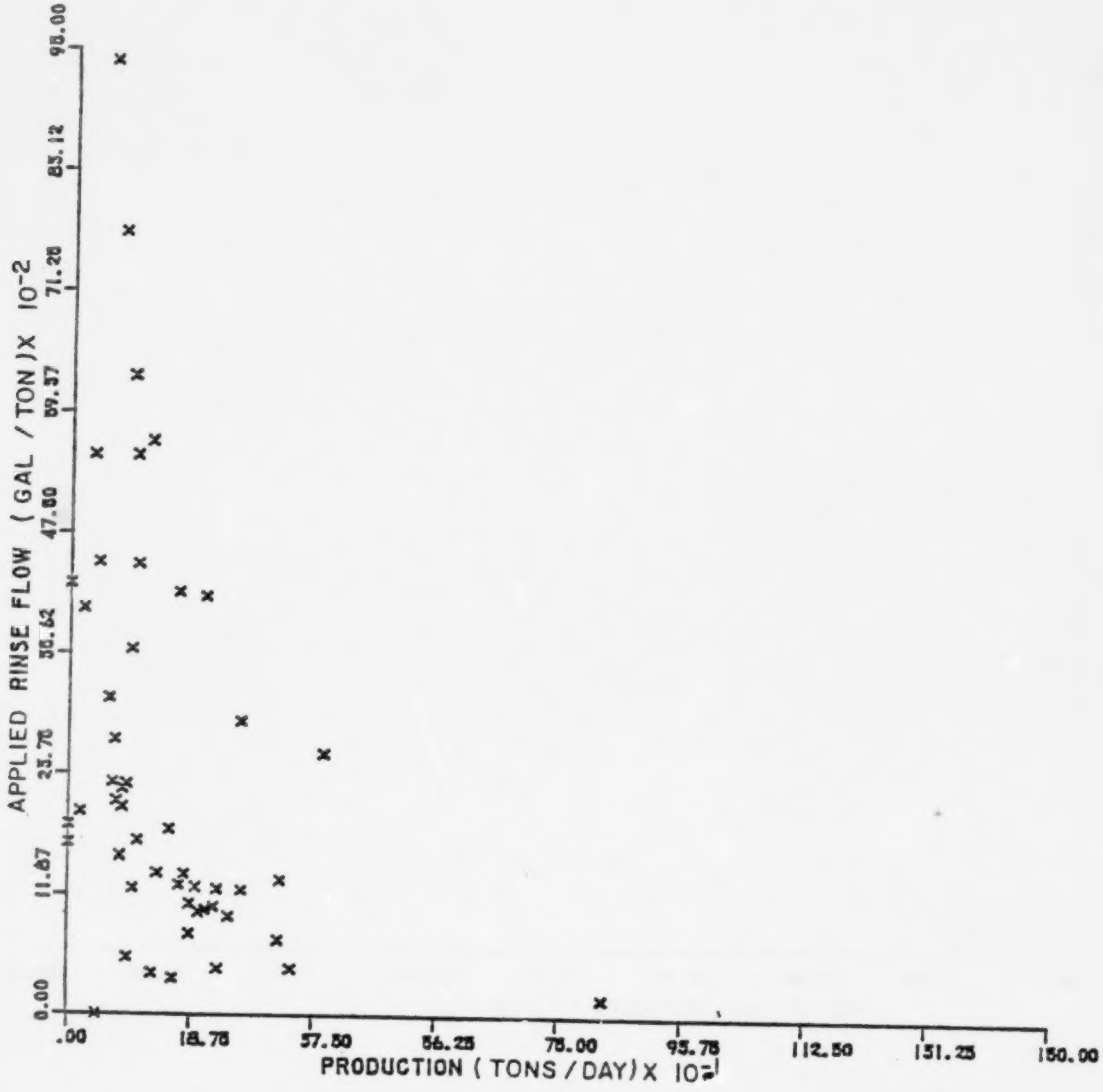


FIGURE IV - 8

SULFURIC ACID PICKLING - BATCH

APPLIED RINSE FLOW (GAL/TON) vs.
AGE (FIRST YEAR OF PRODUCTION)

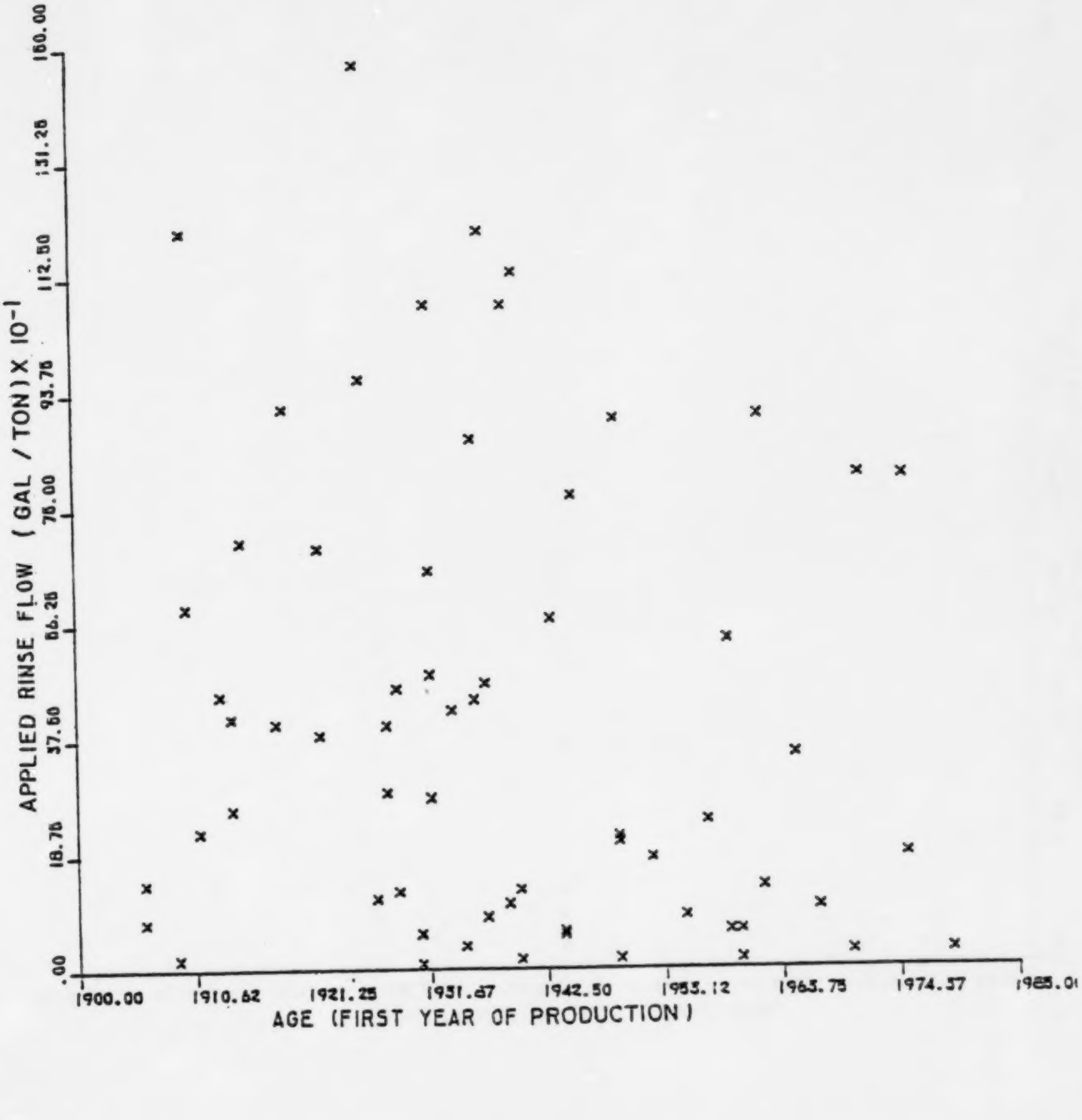


FIGURE IV- 9

SULFURIC ACID PICKLING - CONTINUOUS
APPLIED RINSE FLOW (GAL /TON)
AGE (FIRST YEAR OF PRODUCTION)

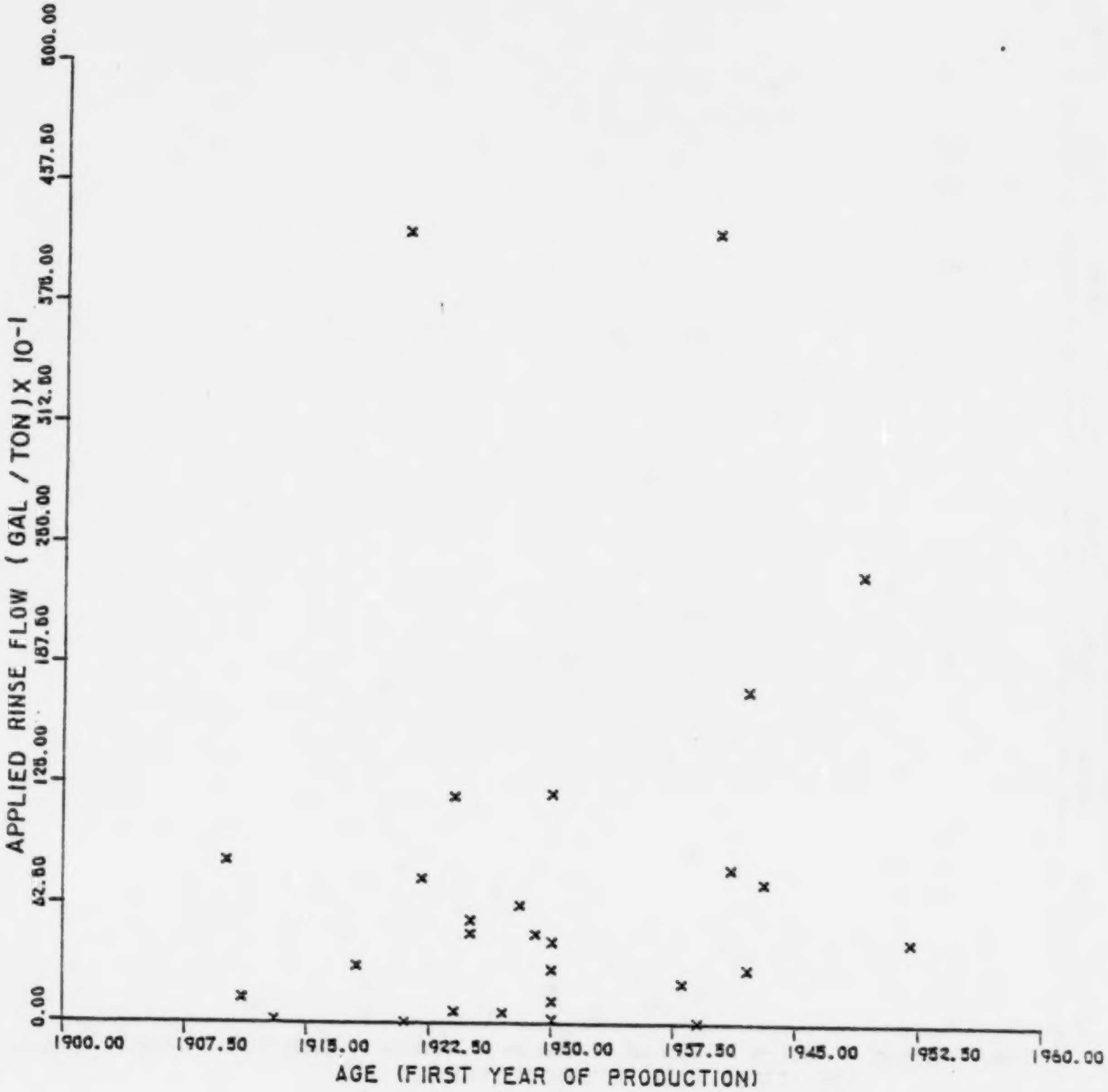


FIGURE IV - 10
HYDROCHLORIC ACID PICKLING - ALL PLANTS
APPLIED RINSE FLOW (GAL /TON) vs. AGE (FIRST YEAR OF PRODUCTION)

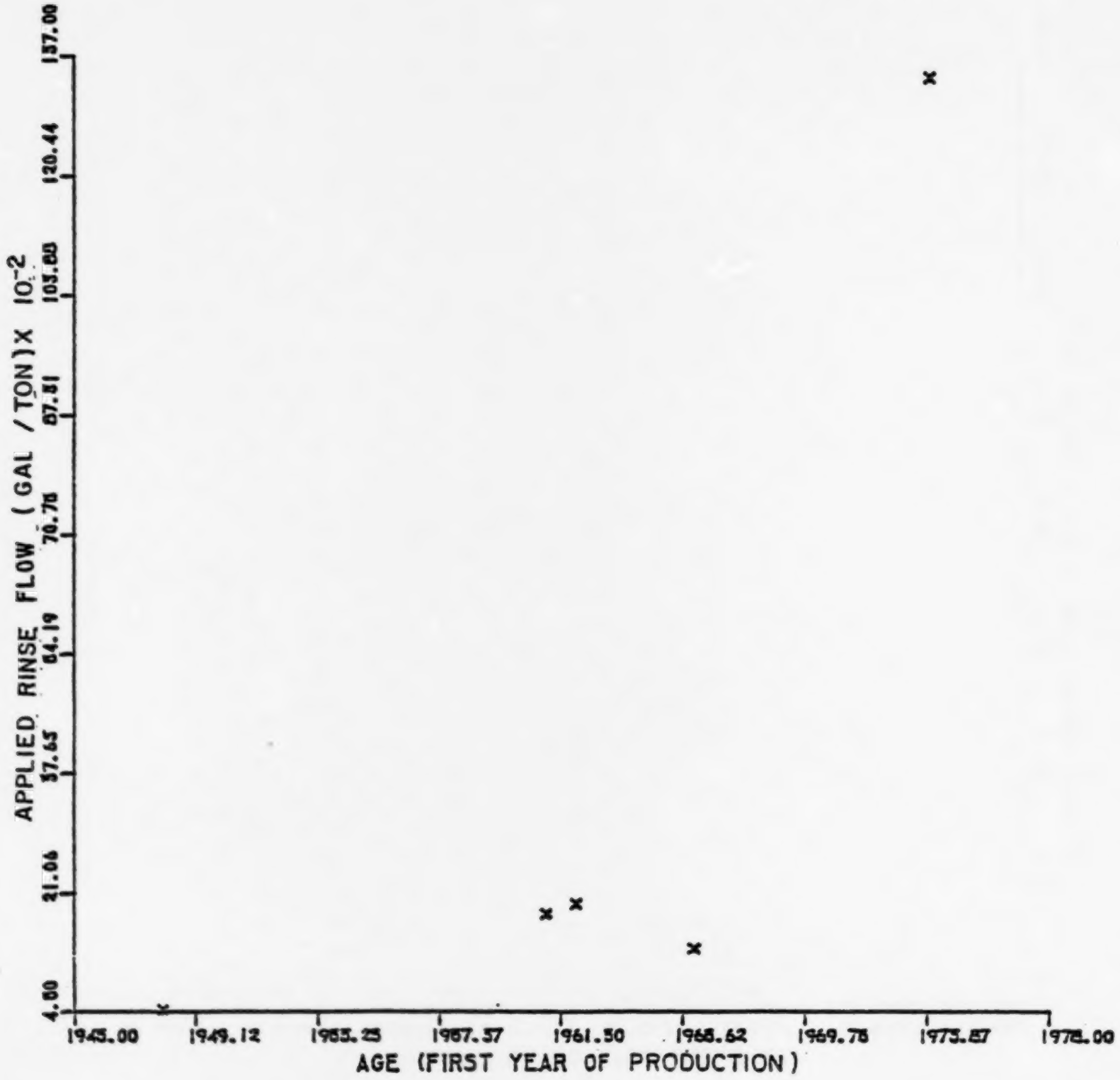


FIGURE IV - 11

HYDROCHLORIC ACID PICKLING - CONTINUOUS

APPLIED RINSE FLOW (GAL/TON)

AGE (FIRST YEAR OF PRODUCTION)

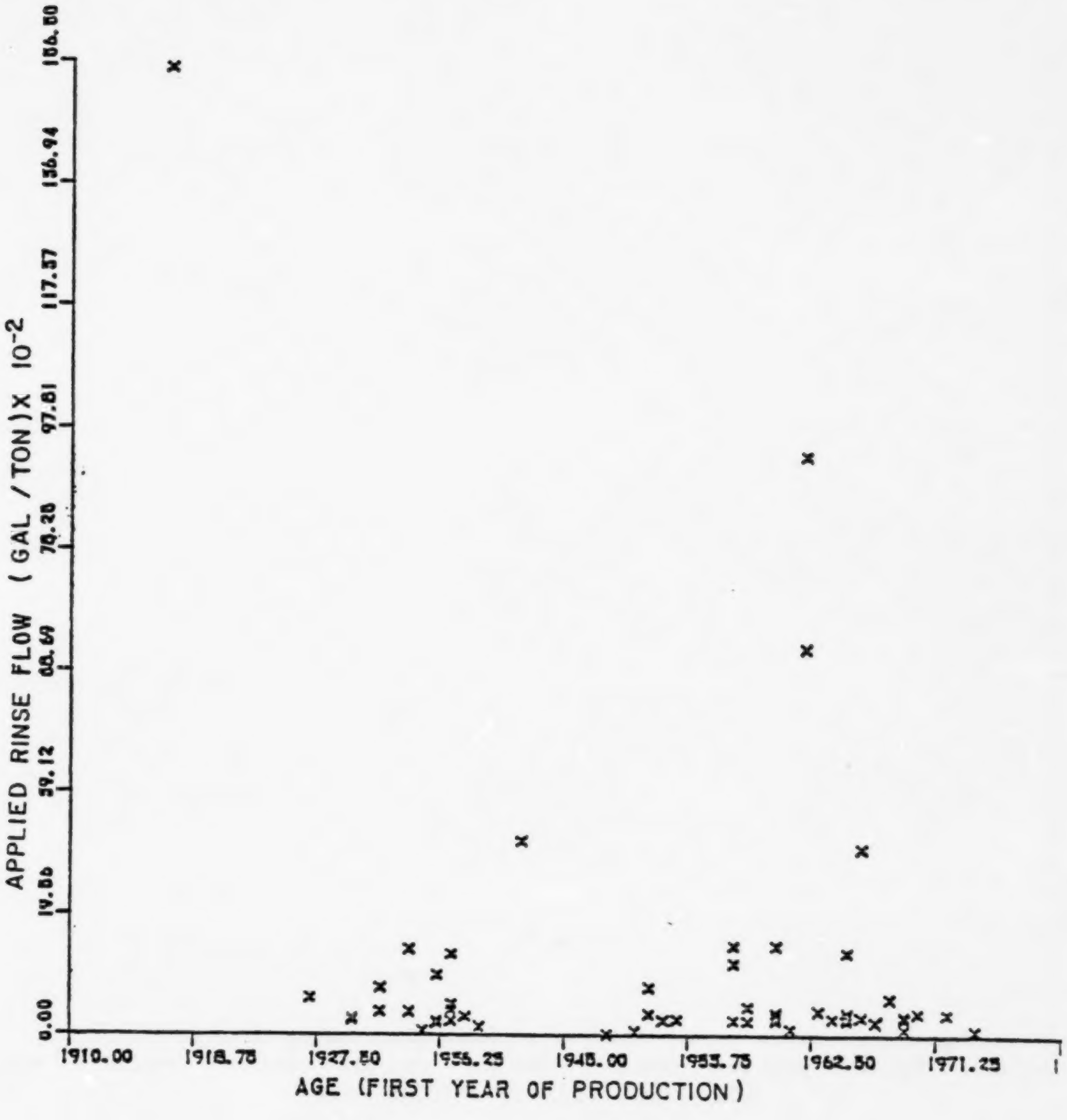


FIGURE IV - 12

HYDROCHLORIC ACID PICKLING - ALL PLANTS

APPLIED RINSE FLOW (GAL /TON)

AGE (FIRST YEAR OF PRODUCTION)

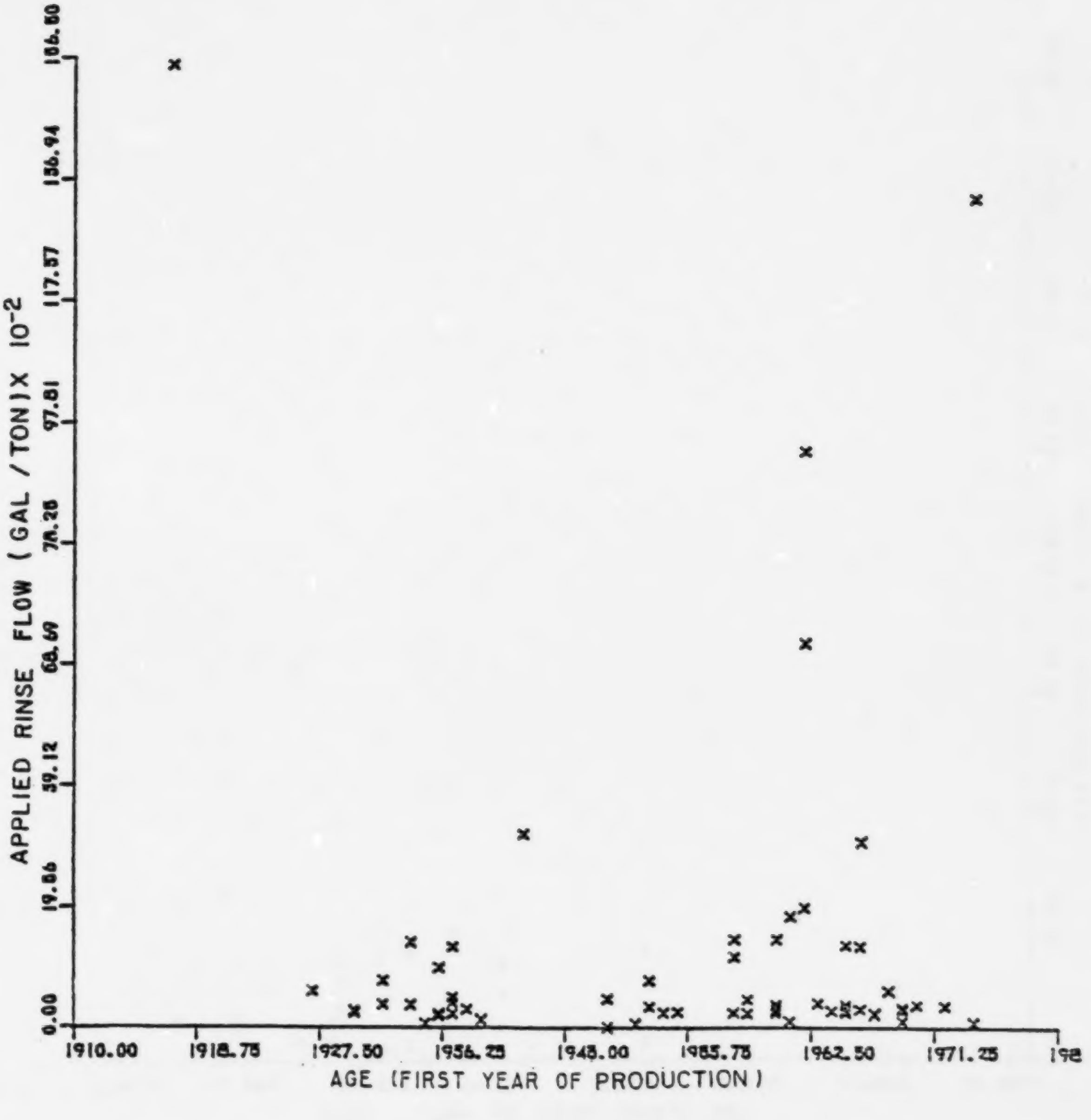


FIGURE IV- 13

COMBINATION ACID PICKLING - BATCH
APPLIED RINSE FLOW (GAL /TON)
AGE (FIRST YEAR OF PRODUCTION)

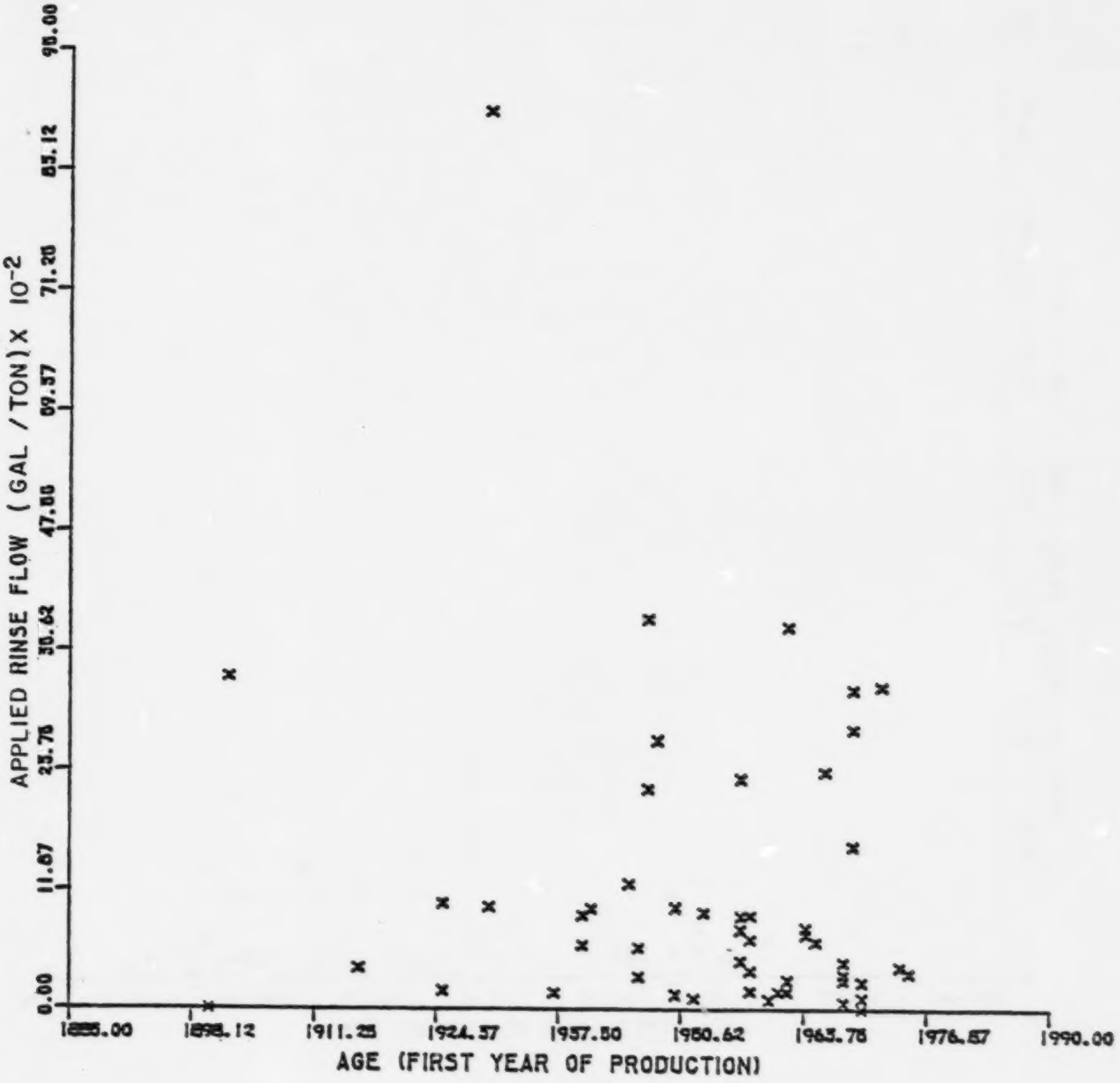
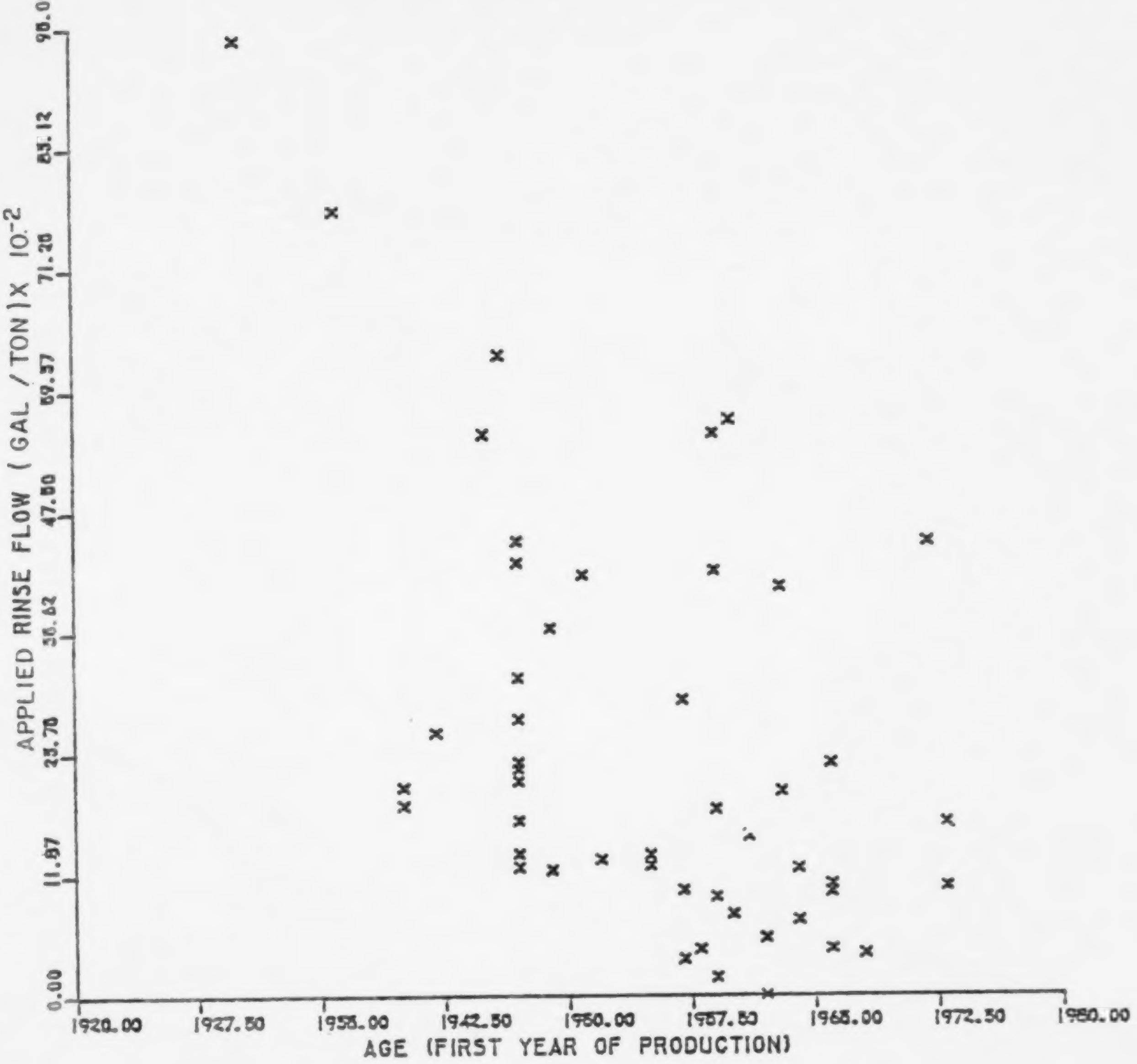


FIGURE IV- 14

COMBINATION ACID PICKLING - CONTINUOUS
APPLIED RINSE FLOW (GAL /TON) vs.
AGE (FIRST YEAR OF PRODUCTION)



ACID PICKLING SUBCATEGORY

SECTION V

WATER USE AND WASTE CHARACTERIZATION

Introduction

Process water usage within the steel industry is a major factor in determining pollutant loads and estimating the cost of wastewater treatment. The Agency used the data from the sampling inspections and responses to the DCPs to evaluate process water usage within this subcategory, and to obtain total wastewater volumes. The Agency identified, for each line, existing control and treatment technology and the method of wastewater disposal.

This section characterizes the wastewaters from acid pickling operations and reviews the actual operation of the pickling process. The waste characterization is based upon data obtained from two sampling programs. During the first sampling program, the Agency investigated the levels of the previously limited pollutants. During the second program, additional monitoring was conducted for toxic pollutants. When an operation was visited twice, only the more recent data were used to characterize wastes from that operation.

Only process wastewaters are considered herein. Noncontact cooling or nonprocess waters are not limited by the proposed regulation. Process wastewater is that water which comes into contact with the process, product, by-product, or raw materials, thus becoming contaminated with various pollutants characteristic of the process. Noncontact cooling water is defined as that water which does not directly contact processes, products, raw materials, or by-products. Nonprocess cooling water is defined as that water which is used for nonprocess operations, i.e., utilities and maintenance.

Acid Pickling

As shown in Section III, acid pickling is performed either on a batch or continuous basis. Wastewaters are discharged from three sources in the acid pickling process: from the tanks containing the pickle liquor, from the rinsing step(s) following the pickling tank, and from the fume scrubber systems if wet scrubbers are used. Each of these sources is described separately below.

1. Pickle Rinsewater - Batch and Continuous

   The first wastewater source is the rinsing operation following the pickling step. Depending upon whether or not the operation is batch or continuous, varying amounts of water are used and discharged. However, regardless of the type of operation, the rinsewaters constitute higher flows than the other sources and contribute much of the pollutant load to the treatment system.

There can be one or more rinse steps depending upon the pickling operation. A considerable number of lines include a single tank in which the product is rinsed after pickling. However, many lines include multi-step rinsing processes which consist of dip tanks, spray chambers, or other rinsing components. The exact arrangement of the rinses depends greatly upon the degree of rinsing and cooling required.

Rinsewater discharge flows can be minimized with cascade or countercurrent rinse systems. The water flow to the rinse tanks is reduced and cascades from one tank to the next. The fresh water makeup enters the final tank and then discharges from the first rinse tank. The product to be pickled travels in the opposite direction to the water flow and thus is rinsed with successively cleaner water. These systems reduce water flow, concentrate the pollutants in the last rinsing chamber, and achieve more thorough rinsing. Although cascade rinsing is ideally suited to continuous operations, it is also used for batch operations.

The rinsewater flow and the wastewater characteristics can vary considerably depending upon such factors as the number of rinsing steps used and the type of rinsing (i.e., flow-through versus standing; cascade versus conventional), and other factors. The Agency considered these variations in developing these proposed limitations.

Flow data and net concentrations for pollutants found in the rinsewater at batch and continuous lines surveyed for this study are summarized in Tables V-1, V-3, V-6, V-8, V-12, and V-15. Net concentrations are presented to describe the actual levels of pollutants contributed by acid pickling operations. Averages are also listed to show a typical level of pollutants found in discharges from batch and continuous operations.

B. Spent Pickle Liquor

The second source of wastewater in acid pickling operations is spent pickle liquor (SPL) bath, which contains a pickling solution composed of acids or various acid mixtures depending on the type of steel being pickled (i.e., carbon versus specialty), or, on the type of finish desired. Regardless of the type of acid used, however, spent pickle liquors are highly contaminated. The same pickling solution is generally used for several days or weeks to process large tonnages of steel products. The contents of the bath are replaced when the acid loses its strength to the point, where extended pickling times are required or product quality diminishes.

The quality of the SPL can vary greatly, depending on the age of the solution. The wastewater characteristics for the sampled SPL sources are summarized in Tables V-2, V-4, V-7, V-9, V-13, and V-16. If no flow data are presented in these tables for a particular plant, there was no flow from the tanks when the sampling was conducted. Because spent pickle liquor is highly contaminated and low in volume, contract hauling off-site is a common disposal method. Lines that do not have SPL hauled, gradually bleed the liquor into treatment systems for disposal, or recover or regenerate it.

The solutions in the acid tanks are heated to increase the chemical action of the pickling solutions. As a result, the temperatures of the wastes being discharged from the bath can be as high as 93.3°C (200°F).

C. Fume Scrubber Water

The third potential source of wastewater in the acid pickling process is the wet fume scrubber. Wet systems are used to collect and scrub fumes generated in the pickling process. Other types of fume treatments that do not require water are in use at several acid pickling operations. An example of this type of system is the acid demister used at one of the sampled sulfuric acid pickling operations.

Considerable quantities of pollutants are discharged from the fume scrubbing system, as the water scrubs the contaminants carried from the process in the fumes. The concentrations of pollutants discharged from the scrubbers vary considerably and depend upon such factors as the amount of fumes generated in the process, the water usage in the scrubber, and the degree of recycle. The level of pollutants found at the 12 fume scrubber systems sampled are summarized in Tables V-5, V-10, and V-14.

As discussed in later sections, the applied flow to the scrubber system can, however, vary considerably. These flow rates can be reduced significantly by recycling of the scrubber water. Many of the lines with recycle systems on fume scrubbers discharge less than 10 gal/ton. As noted earlier, these blowdowns may be completely reused as rinsewater makeup at sulfuric and hydrochloric acid lines.

D. Absorber Vent Scrubber Water

The regeneration mode of treating spent hydrochloric acid pickling solutions can generate an additional wastewater source. Wet absorber vent scrubbers are used to collect and scrub fumes generated by the acid regeneration process. The concentrations of pollutants discharged from the scrubbers vary considerably and depend upon such factors as the amount of fumes generated in the process, the water usage in the scrubber, and the degree of recycle. Table V-11 summarizes analytical data from absorber vent scrubbers.

The applied flow to the scrubber systems may vary. However, these flow rates may be reduced through recycle. Absorber scrubber recycle systems have demonstrated a discharge of 25 gal/ton. These blowdowns may be reused as rinsewater in hydrochloric acid lines.

TABLE V-1

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
BATCH SULFURIC ACID PICKLING
NET RAW RINSE WASTEWATER - CONCENTRATION (mg/l)

Raw Wastewater

	Plant Code	090	091	092	096	098	I-2A	I-2B	O-2	P-2	Q-2	R-2	S-2	R	
	Reference No.	0476A	0612	0088A	0112I	0684D	0856P	0856P	0590	0312	0894	0240B	0256G	0240A	
	Sample Points	C-(A+B)	F-A	F-D-C-A	D-A	B-A	7-6	3-6	1-2	1	3-4	2-7-6	3-4-2	11-1	Average
	Flow (gal/ton)	91	122	326	604	12.2	207	465	18.0	16.9	8.0	30.8	198	30	164
	Parameters														
	Dissolved Iron	391	2350	51.7	97	2900	350	3.6	43,000	6500	3500	1350	596	8990	5430
	Oil and Grease	22	15	42.8	12	-	4.3	8.4	12	11	0.6	4.5	21	1.3	11.9
	Suspended Solids	-	-	361	126	19	70	21	18	749	20	370	159	1.3	147
	pH	1.7-2.5	1.8	5.9-6.9	3.2-3.7	1.8	2.4-2.6	2.9-6.4	<1.0	1.3-1.6	1.9	2.0	2.2	1.6	<1.0-6.9
22	Parachlorometa-cresol	ND	0.020	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.004
44	Methylene Chloride	ND	ND	0.040	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.008
51	Chlorodibromo-methane	ND	ND	0.070	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.014
57	2-Nitrophenol	0.022	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.004
60	4,6-Dinitro-o-cresol	ND	0.095	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.019
66	Bis(2-ethylhexyl) phthalate	0.078	0.025	2.03	0.042	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.44
67	Butylbenzyl phthalate	0.011	0.034	ND	0.011	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.011
68	Di-n-butyl phthalate	ND	ND	0.055	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.011
70	Diethyl phthalate	0.065	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.013
71	Dimethyl phthalate	0.085	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.017
85	Tetrachloroethylene	0.012	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.002
115	Arsenic	NA	NA	0.08	NA	0.33	NA	NA	NA	NA	NA	NA	NA	NA	0.021
118	Cadmium	-	-	-	-	0.13	NA	NA	NA	NA	NA	NA	NA	NA	0.026
119	Chromium	0.36	3.8	16.3	0.090	2.4	NA	NA	NA	NA	NA	NA	NA	NA	4.59
120	Copper	0.33	0.61	0.74	0.07	3.7	NA	NA	NA	NA	NA	NA	NA	NA	1.09
121	Cyanides	ND	ND	0.075	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.015
122	Lead	-	0.13	ND	0.18	1.89	NA	NA	NA	NA	NA	NA	NA	NA	0.44
124	Nickel	0.42	0.79	1.4	0.080	3.7	NA	NA	NA	NA	NA	NA	NA	NA	1.30
126	Silver	ND	ND	ND	ND	0.020	NA	NA	NA	NA	NA	NA	NA	NA	0.004
128	Zinc	59	27	1.14	15	-	NA	NA	NA	NA	NA	NA	NA	NA	20.6

ND: Not detected (included in average).
NA: Not analyzed.
- : Net calculations yielded negative values.

TABLE V-2

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
BATCH SULFURIC ACID PICKLING
NET RAW SPENT CONCENTRATES - CONCENTRATION (mg/l)

	Raw Wastewater						
	Plant Code	091	092	P-2	Q-2	R-2	
	Reference No.	0612	0088A	0312	0894	0240B	Average
	Sample Points	R-A	C-A	3	1	6	
	Flow (gal/ton)	3.5	14.6	17.6	24.3	10.5	14.1
	Parameter						
	Dissolved Iron	63,000	38,500	46,800	61,900	67,800	55,600
	Oil and Grease	8	14	29	14	NA	16.25
	Suspended Solids	2363	305	26	142	70	581.2
	pH	<1.0	<1.0	1.4	<1	2.0	<1.0-2.0
11	1,1,1,-Trichloroethane	0.010	ND	NA	NA	NA	0.005
23	Chloroform	0.010	ND	NA	NA	NA	0.005
44	Methylene Chloride	ND	0.042	NA	NA	NA	0.021
66	Bis(2-ethylhexyl)phthalate	0.78	0.015	NA	NA	NA	0.40
68	Di-n-butyl phthalate	ND	0.045	NA	NA	NA	0.022
71	Dimethyl phthalate	ND	0.150	NA	NA	NA	0.075
85	Tetrachloroethylene	0.010	ND	NA	NA	NA	0.005
86	Toluene	0.010	ND	NA	NA	NA	0.005
87	Trichloorethylene	0.010	ND	NA	NA	NA	0.005
118	Cadmium	0.25	0.26	NA	NA	NA	0.026
119	Chromium	269	205	NA	NA	NA	237
120	Copper	2.6	4.7	NA	NA	NA	3.7
122	Lead	1.5	-	NA	NA	NA	0.75
124	Nickel	23	27	NA	NA	NA	25
126	Silver	0.59	0.43	NA	NA	NA	0.52
128	Zinc	16	133	NA	NA	NA	75

ND: Not detected.
NA: Not analyzed.
- : Net calculations yeilded negative results.

TABLE V-3

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS SULFURIC ACID PICKLING
NET RINSE WASTEWATERS - CONCENTRATIONS (mg/l)

	Raw Wastewater										
	Plant Code	094(Sheet)	094(Strip)	097	H-2	T-2	QQ-2	SS-2	TT-2	WW-2	
	Reference No.	0948C	0948C	0760	0432A	0792B	0584E	0112A	0856D	0868A	Average
	Sample Point	C-A	D-A	(B+C)-A	3+4-1	1-2	5-1	2-10	1-2-3	1-3	
	Flow (gal/ton)	303	422	11.6	115	21.6	167	202	134	284	184
	Parameter										
	Dissolved Iron	40	98	36	28.7	1833	64.7	63	81.9	357	289
	Oil and Grease	9	7	3.3	6.2	5	-	2	2.4	1.6	4.1
	Suspended Solids	38	29	334	-	49	34.5	76	7.0	6.1	63.7
	pH	3.2-5.7	2.2-2.3	NA	1.9-6.4	1.6	2.7	2	1.8	1.7	1.6-6.4
4	Benzene	*	ND	ND	NA	NA	NA	NA	NA	NA	*
44	Methylene Chloride	0.145	ND	ND	NA	NA	NA	NA	NA	NA	0.048
70	Diethyl phthalate	ND	0.029	ND	NA	NA	NA	NA	NA	NA	0.010
71	Dimethyl phthalate	ND	*	0.015	NA	NA	NA	NA	NA	NA	0.008
115	Arsenic	-	-	1.0	NA	NA	NA	NA	NA	NA	0.33
118	Cadmium	-	0.080	0.1	NA	NA	NA	NA	NA	NA	0.060
119	Chromium	-	0.040	2.91	NA	NA	NA	NA	NA	NA	0.98
120	Copper	0.045	0.13	10.4	NA	NA	NA	NA	NA	NA	3.52
122	Lead	0.03	-	0.240	NA	NA	NA	NA	NA	NA	0.090
124	Nickel	-	-	4.62	NA	NA	NA	NA	NA	NA	1.54
126	Silver	ND	ND	0.847	NA	NA	NA	NA	NA	NA	0.28
128	Zinc	-	0.040	0.20	NA	NA	NA	NA	NA	NA	0.080

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* : Concentration less than 0.010 mg/l.

ND: Not detected.
NA: Not analyzed.
- : Net calculations yielded negative results.

TABLE V-4

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS SULFURIC ACID PICKLING
NET RAW SPENT CONCENTRATES - CONCENTRATION (mg/l)

	Raw Wastewater								
	Plant Code	097	H-2	T-2	QQ-2	SS-2	TT-2	WW-2	
	Reference No.	0760	0432A	0792B	0584E	0112A	0856D	0868A	Average
	Sample Points	E-C	2	-	2	1	4	2	
	Flow (gal/ton)	7.2	14.7	14.6	23.6	10.9	23	44.7	19.8
	Parameters								
	Dissolved Iron	38,750	47,900	34,000	48,300	48,000	70,800	19,000	43,800
	Oil and Grease	35	NA	18	8.5	9.5	18.5	10	16.6
	Suspended Solids	236	18,000	65	128	200	222	91	2706
	pH	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
44	Methylene Chloride	0.055	NA	NA	NA	NA	NA	NA	0.055
115	Arsenic	0.20	NA	NA	NA	NA	NA	NA	0.20
118	Cadmium	0.41	NA	NA	NA	NA	NA	NA	0.41
119	Chromium	26	NA	NA	NA	NA	NA	NA	26
122	Lead	1.19	NA	NA	NA	NA	NA	NA	1.19
124	Nickel	14.4	NA	NA	NA	NA	NA	NA	14.4
126	Silver	0.28	NA	NA	NA	NA	NA	NA	0.28
128	Zinc	2.5	NA	NA	NA	NA	NA	NA	2.5

NA: Not analyzed.
ND: Not deleted.
- : No sample stream number designated.

TABLE V-5

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS SULFURIC ACID PICKLING
NET RAW FUME HOOD SCRUBBER WASTEWATERS - CONCENTRATION (mg/l)

Raw Wastewater				Average
Plant Code	QQ-2	SS-2	TT-2	
Reference No.	0584E	0112A	0856D	
Sample Points	3	3+4+5	2	
Flow (gal/ton)	2	22.6	2.3	9.0
Parameters				
Dissolved Iron	305	0.55	88.7	131.4
Oil and Grease	2.5	2.0	9.0	4.5
Suspended Solids	2.5	7.5	198	69
pH	1.4	1.9	1.7	1.4-1.9

TABLE V-6

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
BATCH HYDROCHLORIC ACID PICKLING
NET RAW RINSE WASTEWATERS - CONCENTRATION (mg/l)

Raw Wastewater			Average
Plant Code	V-2	U-2	
Reference No.	0936	0480A	
Sample Point	1+6-5	1-2	
Flow (gal/ton	167.2	92.9	130.0
Parameters			
Dissolved Iron	270	190	230
Suspended Solids	0	0	0
Oil and Grease	1.5	3	2.3
pH (Units)	2.5-3.4	1.8	1.8-3.4

TABLE V-7

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
BATCH HYDROCHLORIC ACID PICKLING
NET RAW SPENT CONCENTRATES CONCENTRATION (mg/l)

Raw Wastewater			Average
Plant Code	V-2	U-2	
Reference No.	0936	0480A	
Sample Point	(7+8)	3	
Flow (gal/ton)	3.86	6.45	5.16
Parameters			
Dissolved Iron	107,000	77,000	92,000
Suspended Solids	140	40	90
Oil and Grease	NA	NA	NA
pH	<1	<1	<1

TABLE V-8

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS HYDROCHLORIC ACID PICKLING
NET RAW RINSE WASTEWATERS - CONCENTRATION (mg/l)

Raw Wastewater

	Plant Code	I-2	W-2	X-2	Y-2	Z-2	AA-2	BB-2	091	093	095	099	100(a)	100(b)	
	Reference No.	0856P	**	0060B	**	03960	0384A	0060	0612	0396D	0584F	0528B	0384A	0384A	
	Sample Points	4-6	7-3	3-7	5-4	1-4	2-1	5-2	B-G-F-A-L	B-A	G-A	C-F	C-A	H-A	Average
	Flow (gal/ton)	220	227.5	663	87.3	166	5.85	211	328	203	16.9	45.4	289	3.3	188
	Parameters														
	Dissolved Iron	7	136	193	218	11,300	13,700	1100	-	2,530	2,325	1,379	35	2,185	2,700
	Suspended Solids	96	17	-	1.5	72	8	37	-	206	-	16	34	0	37.5
	Oil and Grease	3.9	5	NA	-	9	28	59	-	147	0	9.1	3.0	0	20.3
	pH, Units	4.5-5.0	2.9-3.8	2.2-2.6	1.7	1.1	1.1	1.5-1.7	2.9-3.8	1.0	1.4-1.7	1.9-2.8	4.2	2	<1.0-5.0
23	Chloroform	NA	NA	NA	NA	NA	NA	NA	-	*	0.020	ND	*	*	0.007
39	Fluoranthene	NA	NA	NA	NA	NA	NA	NA	*	0.060	ND	ND	*	ND	0.013
44	Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	-	-	1.20	*	-	-	0.20
60	4,6-Dinitro-o-cresol	NA	NA	NA	NA	NA	NA	NA	0.013	ND	ND	ND	ND	ND	0.002
65	Phenol	NA	NA	NA	NA	NA	NA	NA	*	ND	*	ND	*	-	0.005
66	Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	-	4.705	*	-	-	0.050	0.79
67	Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	-	0.025	ND	ND	ND	*	0.006
68	Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	-	0.112	*	*	*	*	0.025
70	Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	-	ND	ND	ND	*	ND	0.002
71	Dimethyl phthalate	NA	NA	NA	NA	NA	NA	NA	*	0.055	ND	ND	ND	ND	0.011
85	Tetrachloroethylene	NA	NA	NA	NA	NA	NA	NA	*	0.040	0.019	ND	ND	ND	0.012
87	Trichloroethylene	NA	NA	NA	NA	NA	NA	NA	0.057	ND	ND	ND	ND	ND	0.010
114	Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.181	NA	*	0.19	0.124
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	-	0.225	0.25	NA	NA	0.23
118	Cadmium	NA	NA	NA	NA	NA	NA	NA	-	ND	ND	*	*	0.010	0.005
119	Chromium Total	NA	NA	NA	NA	NA	NA	NA	-	0.79	-	0.34	*	0.57	0.28
120	Copper	NA	NA	NA	NA	NA	NA	NA	-	0.67	0.68	0.61	0.06	1.6	0.60
122	Lead	NA	NA	NA	NA	NA	NA	NA	-	0.43	ND	ND	*	0.14	0.10
124	Nickel	NA	NA	NA	NA	NA	NA	NA	-	0.48	0.733	0.63	*	1.28	0.52
128	Zinc	NA	NA	NA	NA	NA	NA	NA	160	1.41	0.416	0.13	0.14	0.38	27.1

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* : Calculation yielded values less than 0.010 mg/l.
**: Plant has no reference number.

(a) Normalizing acid rinse
(b) Cascade rinse

ND: Not detected
NA: Not analyzed
- : Calculation yielded a negative value

TABLE V-9

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS HYDROCHLORIC ACID PICKLING
NET RAW SPENT CONCENTRATES - CONCENTRATION (mg/1)

	Raw Wastewater										
	Plant Code	I-2	W-2	Z-2	AA-2	091	093	095	099	100	Average Flow
	Reference No.	0856F	-	0396D	0384A	0612	0396D	0584F	0528B	0384A	
	Sample Points	8-6	1-3	3-4	3-1	L-A	B(1)-A	B-A	B-A	K-A	
	Flow (gal/ton)	220	11.9	41.4	3.26	18.1	203	49.7	81.7	4.6	70.4
	Parameters										
	Dissolved Iron	7.1	137,700	44,300	116,000	56,000	3950	8,000	75,500	18,000	51,050
	Suspended Solids	54	97	120	40	3,026	240	74.0	42.0	316	445
	Oil and Grease	NA	5.1	0	0	4.0	237	4.0	11.0	5.0	33.3
	pH, Units	4.5-5.0	0.6-0.7	<1	<1	<1	1.0	1.3-3.0	<1	<1	0.6-3.0
23	Chloroform	NA	NA	NA	NA	*	*	0.101	*	0.011	0.022
44	Methylene Chloride	NA	NA	NA	NA	*	ND	2.333	0.014	0.409	0.55
65	Phenol	NA	NA	NA	NA	ND	ND	0.013	ND	ND	0.003
66	Bis(2 ethylhexyl) phthalate	NA	NA	NA	NA	*	ND	0.017	1.550	0.155	0.344
67	Butyl benzyl phthalate	NA	NA	NA	NA	ND	ND	ND	0.011	0.045	0.011
68	Di-n-butyl phthalate	NA	NA	NA	NA	ND	ND	ND	0.033	ND	0.007
85	Tetrachloroethylene	NA	NA	NA	NA	ND	ND	0.031	ND	ND	0.006
87	Trichloroethylene	NA	NA	NA	NA	0.028	ND	ND	ND	ND	0.006
114	Antimony	NA	NA	NA	NA	NA	NA	0.187	NA	4.1	2.14
115	Arsenic	NA	NA	NA	NA	NA	0.05	0.025	0.39	NA	0.155
118	Cadmium	NA	NA	NA	NA	0.028	0.02	ND	0.26	0.28	0.12
119	Chromium Total	NA	NA	NA	NA	37.0	0.84	1.505	17.0	8.7	13.0
120	Copper	NA	NA	NA	NA	22.0	0.67	2.42	19.0	11.0	11.0
122	Lead	NA	NA	NA	NA	1550	0.43	ND	*	2.1	311
124	Nickel	NA	NA	NA	NA	22.0	0.48	2.505	13.0	13.0	10.2
128	Zinc	NA	NA	NA	NA	61.0	1.5	2.505	4.20	4.50	14.7

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* : Calculation yielded vaules less than 0.010 mg/1.

NA: Not analyzed.
ND: Not detected.

TABLE V-10

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS HYDROCHLORIC ACID PICKLING
NET RAW FUME HOOD SCRUBBER WASTEWATERS - CONCENTRATION (mg/1)

Raw Wastewater							
Plant Code	W-2	Y-2	093	095	099	100	Average
Reference No.	**	**	0396D	0584F	0528B	0384A	
Sample Points	6-4	4-6	J-A	GA2-G	F-A	J-H	
Flow (gal/ton)	45.5	39.7	31.1	0.39	6.1	3.4	21.0
Parameters							
Dissolved Iron	23.9	3.7	880	662	45	1025	440
Suspended Solids	3.0	1.7	2098	-	6	9	353
Oil and Grease	5.3	-	325	43.8	4	-	63.0
pH (Units)	2.8-3.7	1.8-1.9	1.6	1.2	<1.0	1.0-1.2	<1.0-3.7
6 Carbon Tetrachloride	NA	NA	ND	0.017	ND	ND	0.004
23 Chloroform	NA	NA	*	0.332	*	*	0.091
64 Pentachlorophenol	NA	NA	ND	ND	0.043	ND	0.011
66 Bis(2 ethylhexyl)phthalate	NA	NA	-	*	0.320	-	0.083
67 Butyl benzyl phthalate	NA	NA	0.325	ND	0.026	*	0.090
69 Di-n-octyl phthalate	NA	NA	0.358	0.055	0.01	*	0.109
114 Antimony	NA	NA	NA	0.106	NA	0.1	0.103
115 Arsenic	NA	NA	0	0.039	0.070	NA	0.036
119 Chromium	NA	NA	0.24	-	0.09	0.15	0.12
120 Copper	NA	NA	0.76	0.267	0.10	0.1	0.31
122 Lead	NA	NA	0.35	-	-	-	0.009
124 Nickel	NA	NA	0.20	-	0.080	0.1	0.095
128 Zinc	NA	NA	1.6	0.159	0.009	0.07	0.460

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* : Calculation yielded a value less than 0.010 mg/1.
NA: Not analyzed.
- : Calculation yielded a negative result.
ND: Not detected.
**:, Plants have no assigned reference number.

TABLE V-11

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS HYDROCHLORIC ACID PICKLING
NET RAW ABSORBER VENT SCRUBBER WASTEWATERS - CONCENTRATION (mg/l)

Raw Wastewater		W-2	X-2	Y-2(a)	Y-2(b)	095	099	
	Plant Code	W-2	X-2	Y-2(a)	Y-2(b)	095	099	
	Reference No.	**	0060B	**	**	0584F	0528B	Average
	Sample Points	5	2-1	1-6	2-6	C-A	E-A	
	Flow (gal/ton)	98.6	200	288	336	69	170	197
	Parameters							
	Dissolved Iron	15	63.5	-	0.41	3658	150	650
	Suspended Solids	129	70	85	1.5	65	51	67
	Oil and Grease	2.2	-	-	-	-	-	0.4
	pH (Units)	3.7-7.6	6.9-7.1	7.0-7.1	1.7	1.7-2.1	<1.0-2.3	1.7-7.6
30	1,2-Transdichloroethylene	NA	NA	NA	NA	0.109	ND	0.055
44	Methylene Chloride	NA	NA	NA	NA	1.070	0.031	0.55
66	Bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	0.046	0.012	0.029
69	Di-n-octyl phthalate	NA	NA	NA	NA	0.021	ND	0.011
71	Dimethyl phthalate	NA	NA	NA	NA	0.030	ND	0.015
85	Tetrachloroethylene	NA	NA	NA	NA	0.011	ND	0.006
114	Antimony	NA	NA	NA	NA	0.209	NA	0.209
115	Arsenic	NA	NA	NA	NA	0.017	*	0.014
119	Chromium	NA	NA	NA	NA	-	0.98	0.49
120	Copper	NA	NA	NA	NA	1.27	0.436	0.85
122	Lead	NA	NA	NA	NA	-	0.10	0.05
124	Nickel	NA	NA	NA	NA	0.790	0.64	0.72
128	Zinc	NA	NA	NA	NA	1.09	0.71	0.90

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*: Calculation yielded a value less than 0.010 ug/l.
-: Calculation yielded a negative result.

(a) Acid regeneration unit with cyclone.
(b) Acid regeneration unit with electrostatic precipitator.

NA: Not analyzed.
ND: Not detected.
**: Plant has no assigned reference number.

TABLE V-12

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
BATCH COMBINATION ACID PICKLING
NET RAW RINSE WASTEWATERS - CONCENTRATION (mg/l)

Raw Wastewater

	Plant Code	C	F	L	U	123	124	125	
	Reference No.	0424-01	0856H	0440A-01	0748	0088A	0088D	0884E	
	Sample Points	2 City Water	1-9	10-Well Water	1-8	D-A	B-A	C-A	Average
	Flow (gal/ton)	91	279	140	677	310	1,176	650	475
	Parameters								
	Suspended Solids	404	-	165	-	35	1	1	86.6
	Oil and Grease	-	0.1	0.9	2.2	2	9	3.0	2.5
	Fluoride	635	173	0.33	500	NA	24.0	49.9	230.4
	Dissolved Iron	717	60.3	133	1,080	46	10	5.0	293
	pH, Units	0.4-0.8	2.6-2.9	2.8-3.0	1.9	2.6-2.7	2.7	3.5-3.6	0.4-3.6
23	Chloroform	NA	NA	NA	NA	-	-	0.047	0.016
44	Methylene Chloride	NA	NA	NA	NA	-	0.040	0.028	0.023
66	Bis(2 ethylhexyl)phthalate	NA	NA	NA	NA	0.266	0.138	-	0.135
67	Butyl benzyl phthalate	NA	NA	NA	NA	*	*	0.125	0.048
68	Di-n-butyl-phthalate	NA	NA	NA	NA	*	*	*	*
85	Tetrachloroethylene	NA	NA	NA	NA	-	-	*	*
115	Arsenic	NA	NA	NA	NA	0.01	0.01	0.01	0.01
119	Chromium	111	13.4	24.4	152	2.9	25.9	1.07	47.2
120	Copper	4.6	-	0.8	1.38	0.24	*	0.05	31.01
121	Cyanide	0.12	0.12	NA	NA	-	*	-	0.050
122	Lead	-	-	-	-	0.10	0.05	0.05	0.030
124	Nickel	156	9.4	12.5	70	7.4	27	0.54	40.4
128	Zinc	0.87	0.05	0.02	5.1	0.06	0.03	-	0.88

ND : Not detected.
Unk: Unknown.
NA : Not analyzed.
* : Concentration less than 0.010 mg/l.
- : Calculations yields a negative value.

TABLE V-13

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
BATCH COMBINATION ACID PICKLING
NET RAW SPENT CONCENTRATES - CONCENTRATION (mg/1)

Raw Wastewater											
	Plant Code	C(1)	C(2)	E	F	L	M	S	T	U	
	Reference No.	0424	0424	020B	0856H	0440A	0432J	0060I	Unk	0748	
	Sample Points	11	12	14	11	5	15	7	9	2	
	Flow (gal/ton)	-	-	-	-	-	-	-	-	-	
	Parameter										
	Dissolved Iron	13,200	13,200	15,700	34,300	1.2	NA	8,240	34,500	30,400	18,693
	Fluoride	1,700	7	18	7,000	232	17,000	380	NA	NA	3,762
	Nitrate	NA	NA	16,000	8,800	NA	1,481	NA	NA	NA	8,760
	Oil and Grease	0.2	0.2	0.4	NA	NA	NA	NA	NA	NA	0.4
	Suspended Solids	224	44	114	100	123	60	236	NA	16	115
	pH, Units	1.2	0.3	0.8	2.2	NA	1.2	0.8	0.9	2.3	0.3-2.3
118	Cadmium	0.09	0.118	0.06	0.22	NA	0.32	0.17	0.3	0.35	0.20
119	Chromium	2,090	1360	2,426	6,800	NA	6,720	1,424	5,040	7,000	3,651
120	Copper	114	6.79	78	54	NA	640	52	632	144	19
122	Lead	*	*	5.7	2.64	NA	NA	1.28	7.1	1.2	2.56
124	Nickel	2,832	1786	2,123	4,200	NA	5,980	1,552	17,200	9,040	5,589
128	Zinc	0.97	2.15	1.6	85	NA	7.2	1.6	32	5.8	17.0

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(1) Pickle line utilized HNO_3-HF acids.
(2) Pickle line utilized H_2SO_4 acid

ND : Not detected.
NA : Not analyzed.
Unk: Unknown.
* : Concentration is less than 0.010 mg/1

TABLE V-14

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
BATCH COMBINATION ACID PICKLING
NET RAW FUME HOOD SCRUBBER WASTEWATERS - CONCENTRATION (mg/l)

	Raw Wastewater			
	Plant Code	F	125	
	Reference No.	856H	884E	Average
	Sample Points	2-9	B-A	
	Flow (gal/ton)	50.4	10.0	30.2
	Recycle System Installed	No	Yes	
	Parameter			
	Suspended Solids	-	23.0	11.5
	Oil and Grease	0.2	23.0	11.6
	Fluoride	1,802	5,500	3,650
	Dissolved Iron	45.7	503	274.4
	pH, Units	1.5-2.0	2.9	1.5-2.9
1	Acenapthene	NA	0.017	0.017
21	2,4,6-Trichlorophenol	NA	0.023	0.023
22	Parachlorometacresol	NA	ND	ND
31	2,4-Dichlorophenol	NA	0.022	0.022
34	2,4-Dimethylphenol	NA	0.045	0.045
39	Fluoranthene	NA	*	*
44	Methylene Chloride	NA	*	*
67	Butyl benzyl phthalate	NA	0.027	0.027
68	Di-n-butyl phthalate	NA	0.135	0.135
69	Di-n-octyl phthalate	NA	0.080	0.080
70	Diethyl phthalate	NA	*	*
71	Dimethyl phthalate	NA	0.076	0.076
115	Arsenic	NA	0.57	0.57
119	Chromium	2.42	69	35.7
120	Copper	0.07	1.8	0.94
121	Cyanide	*	0.10	0.088
122	Lead	NA	0.04	0.04
124	Nickel	3.3	47	25.2
128	Zinc	0.30	1.5	0.90

NA: Not analyzed.
ND: Not detected.
- : Calculations yielded a negative result.
* : Calculations yielded a value less than 0.01 mg/l.

TABLE V-15

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS COMBINATION ACID PICKLING
NET RAW RINSE WASTEWATERS - CONCENTRATION (mg/l)

	Raw Wastewater					
	Reference No.	248B	432K-02	176-03	0900	
	Plant Code	D	I	O	121	Average
	Sample Points	4-1	4-1	29-32	B-A	
	Flow (gal/ton)	1,016	1,814	974	2,754	1,640
	Parameter					
	Suspended Solids	10	553	76	-	160
	Oil and Grease	-	0.6	9.5	2	3.0
	Fluoride	76.5	31.4	15.4	169.0	73.1
	Dissolved Iron	103.5	59.2	1.71	148	78.1
	pH, Units	3.8	3.2-7.2	5.4-8.2	2.4-2.7	2.4-8.2
4	Benzene	NA	NA	NA	0.028	0.028
23	Chloroform	NA	NA	NA	0.184	0.184
44	Methylene Chloride	NA	NA	NA	0.501	0.501
66	Bis(2 ethylhexyl)phthalate	NA	NA	NA	0.017	0.017
85	Tetrachloroethylene	NA	NA	NA	0.030	0.030
114	Antimony	NA	NA	NA	0.060	0.060
115	Arsenic	NA	NA	NA	0.012	0.012
119	Chromium	16.0	17.1	0.48	32.2	16.4
120	Copper	0.11	0.14	0.040	0.528	0.205
124	Nickel	9.2	5.98	2.14	19.4	9.18
128	Zinc	-	0.747	0.070	0.317	0.284
	Nitrates	11.0	14.4	20.3	NA	15.1

NA: Not analyzed.
- : Calculations yielded a negative number.

TABLE V-16

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
CONTINUOUS COMBINATION ACID PICKLING
NET RAW SPENT CONCENTRATES - CONCENTRATION (mg/l)

	Raw Wastewater							
	Plant Code	A	D(1)	D(2)	I	O(1)	O(2)	Average
	Reference No.	0900	248B	248B	0432K	0176	0176	
	Sample Point	12	14	13	12	23	26	
	Flow (gal/ton)	NA	NA	NA	4.2	NA	NA	4.2
	Parameters							
	Oil and Grease	2.6	2.2	2.0	7.1	NA	NA	3.5
	Suspended Solids	196	318	196	109	NA	NA	205
	Dissolved Iron	989	74,700	36,900	20.6	16,200	6,960	22,595
	Fluoride	15,000	2.5	6.4	26,000	NA	NA	10,253
	pH, Units	0.7	2.2	2.1	1.1	2.0	0.9	0.7-2.2
118	Cadmium	0.05	0.08	0.07	0.1	0.05	0.02	0.06
119	Chromium	2,400	6,242	3,481	4,284	2,361	1,248	3,336
120	Copper	36	80	28	37	416	16	102
122	Lead	1.3	1.4	1.4	NA	1.2	0.6	1.2
124	Nickel	2,300	4,680	1,952	2,031	4,914	3,822	3,283
128	Zinc	1.4	6.4	4.0	1.1	10.8	0.76	4.1
	Nitrate	463	NA	226	3,550	NA	NA	1,413

NA: Not available

ACID PICKLING SUBCATEGORY

SECTION VI

SELECTION OF POLLUTANTS

The final selection of pollutants for the acid pickling subcategory was based on the analysis of wastewater samples collected during this study. A number of pollutants originally limited by the 1976 regulation were selected, because they characterize the wastes from the pickling operation. The pollutants limited by this proposed regulation include those listed in the 1976 regulation plus certain toxic pollutants found during extensive monitoring conducted for this study. This section describes the pollutants considered for regulation, presents the rationale for selecting those pollutants, and the process sources of those pollutants.

Pollutant Selection

Conventional Pollutants

In the original regulation, three conventional pollutants were limited for all types of acid pickling operations: total suspended solids, oil and grease, and pH. However, the limitations for the oil and grease were applicable only when pickling wastes were treated jointly with cold rolling wastes. Wastewater characteristics for batch and continuous operations are similar, such that the same limited pollutants can apply to both types of operations in each acid subdivision.

Based upon the information gathered during this study, the Agency decided to retain oil and grease on the list of limited pollutants in certain instances. Cold rolling wastes and pickling wastes are often co-treated to take advantage of emulsion breaking properties of the acid wastes. Since this is a common practice, and since the pickling wastewaters can contain moderate amounts of oils, an allowance for oil and grease is included in the proposed limitations.

High levels of suspended solids and low pH are also characteristic of acid pickling operations. Solids are generated in the pickling process and are carried away in either the rinse or fume scrubber waters or in the spent pickle liquor bath. In addition, pH was also limited in the original regulation for this subcategory and will continue to be regulated by the proposed limitations. The pH of the raw wastes from acid pickling lines is always acidic, with typical values ranging from <1 to 4 standard units. Wastewaters with low pH values can have detrimental effects if discharged without treatment. Neutralization is required to bring the pH to within the regulated levels of 6.0-9.0 standard units.

Other Pollutants

In the original regulation, several nonconventional nontoxic pollutants were limited. Dissolved iron was limited for all three acid pickling operations. In addition, dissolved chromium, fluoride, and dissolved nickel were all limited for combination acid pickling operations. (The fluoride limitation applied only to those mills using hydrofluoric acid). Limitations for these four pollutants are being retained in the present regulation. However, chromium and nickel are now limited on a total rather than a dissolved basis at BAT, NSPS, PSES, and PSNS. The Agency made this change to more accurately reflect the true pollutant load characteristics of these wastewaters.

Toxic Pollutants

Besides the pollutants limited during the first phase of this study, the Agency found that toxic pollutants are present at significant levels in the discharges from acid pickling operations. During the second phase of sampling, the Agency conducted additional monitoring for the pollutants limited in the 1976 regulation, toxic pollutants, and other pollutants. Based upon this sampling and responses provided by the industry, the Agency developed a list which summarizes toxic pollutants known to be present in the wastewater. (Table VI-1).

The Agency tabulated and calculated a composite concentration value for each pollutant in the raw wastewater. A net value was used to describe the contribution of pollutants from the pickling process. If a pollutant was found in the raw wastewater at an average concentration (net) of 0.010 mg/l or greater, it was considered to be characteristic of acid pickling wastewater and is addressed accordingly throughout this report. Also shown in Table VI-2 are the other pollutants for which limitations are being considered.

Several organic pollutants were detected at concentrations greater than 0.010 mg/l but are not listed in Table VI-2. These pollutants were omitted because it is believed that their presence is not due to acid pickling operations. Methylene chloride was omitted because it is a solvent commonly used as a cleaning agent in the laboratory, and its presence is ascribed to this practice and not to acid pickling operations. Also, some phthalate compounds were detected at levels greater than 0.010 mg/l, but they are not believed to be representative of acid pickling wastes. Evidence developed during the sampling inspections indicates that the presence of phthalates was probably related to plasticizers in the tubing used in collecting the samples. Only two toxic organic pollutants, namely, chloroform in hydrochloric acid pickling and benzene in combination acid pickling, are listed. These are common solvents that may occur in the pickling process under certain operating circumstances, or may originate from oils present on the steel product which is pickled.

As noted in Table VI-2, many toxic metal pollutants were detected at concentrations greater than 0.010 mg/l. These pollutants, as with the pollutants limited in the 1976 regulation, are present in the wastewater because of the extreme chemical action that occurs during the pickling process. The acids remove the surface scale from the steel products which contain the toxic metals. While these pollutants may vary in concentration from line to line, they are characteristic of the process. The Agency is proposing BAT, NSPS, PSES, and PSNS limitations and standards for these toxic pollutants, together with the previously limited pollutants.

TABLE VI-1

PRIORITY POLLUTANTS KNOWN TO BE PRESENT IN ACID PICKLING OPERATIONS

		Sulfuric Acid Pickling	Hydrochloric Acid Pickling	Combination Acid Pickling
004	Benzene	-	-	X
021	2,4,6-Trichlorophenol	-	-	X
023	Chloroform	-	X	X
031	2,4-Dichlorophenol	-	-	X
039	Fluoranthene	-	X	-
044	Methylene Chloride	X	X	X
051	Chlorodibromomethane	X	-	-
066	Bis(2-ethylhexyl)phthalate	X	X	X
067	Butyl benzyl phthalate	X	X	X
068	Di-n-butyl phthalate	X	X	X
069	Di-n-octyl phthalate	-	X	X
070	Diethyl phthalate	X	-	-
071	Dimethyl phthalate	X	-	-
085	Tetrachloroethylene	-	X	X
087	Trichloroethylene	-	X	-
114	Antimony	-	X	X
115	Arsenic	X	X	X
118	Cadmium	X	X	X
119	Chromium	X	X	X
120	Copper	X	X	X
121	Cyanide, Total	X	-	X
122	Lead	X	X	X
124	Nickel	X	X	X
126	Silver	X	-	-
128	Zinc	X	X	X

X: Parameter known to be present in at least one of the waste sources.
-: Parameter not found.

TABLE VI-2

SELECTED POLLUTANTS - ACID PICKLING OPERATIONS

		Sulfuric Acid Pickling	Hydrochloric Acid Pickling	Combination Acid Pickling
	Dissolved Iron	X	X	X
	Fluoride	-	-	X
	Oil and Grease	X	X	X
	Suspended Solids	X	X	X
	pH	X	X	X
4	Benzene	-	-	X
23	Chloroform	-	X	-
114	Antimony	-	X	-
115	Arsenic	X	X	X
118	Cadmium	X	X	-
119	Chromium	X	X	X
120	Copper	X	X	X
122	Lead	X	X	X
124	Nickel	X	X	X
126	Silver	-	X	-
128	Zinc	X	X	X

X: Parameter selected.
-: Parameter not selected.

ACID PICKLING SUBCATEGORY

SECTION VII

CONTROL AND TREATMENT TECHNOLOGY

Introduction

This section reviews existing wastewater treatment practices for the acid pickling subcategory and lists those technologies which were considered by the Agency in developing this proposed regulation. The sampling data gathered at the acid pickling operations visited during this study and a description of the treatment practiced at each are also presented.

As a first step, it was necessary for the Agency to determine the level of existing wastewater treatment in the acid pickling subcategory. The Agency then developed BPT, BAT, BCT, PSES, and PSNS alternative treatment systems in an "add-on" fashion to this base level. The NSPS alternative treatment systems, however, were not developed in this manner. Since NSPS applies to new acid pickling operations, the Agency did not consider the "add-on" approach. The alternative treatment systems (levels of treatment) and their corresponding effluent characteristics are summarized in Sections IX through XIII.

Summary of Treatment Practices Currently Employed

Because there is the potential for three different wastewater sources, the treatment systems used on each source are discussed in detail below, prior to a discusion of the general treatment scheme.

Treatment of Spent Pickle Liquor

Spent pickle liquor is presently classified as a hazardous waste under the Resource Conservation and Recovery Act (RCRA). Special attention must be given to this waste to insure that it is either properly disposed of, or that it is treated sufficiently prior to discharge. There are several different methods for handling spent acid concentrates (spent pickle liquor). These methods include disposal, treatment, or recovery/regeneration processes.

A. Disposal Methods

The disposal methods, which include contract hauling and deep well injection, are not ideal solutions for handling the spent acid concentrates. Hauling, and deep well injection move the wastes from one place to another, and therefore, only relocate the pollution. However, if properly performed any adverse environmental effects can be minimized to levels comparable to treatment of these wastes. Contract hauling is a commonly used method in the industry. Several plants dispose of their spent pickle liquor by deep well injection.

B. Treatment Processes

Treatment processes include chemical neutralization and precipitation. Detailed discussions of these processes follow. Treatment may be performed separately or jointly with the other wastewaters from the pickling operation. These methods are commonly employed throughout the industry.

The ideal method for handling spent pickle liquor is to recycle the wastes through recovery/regeneration processes. These processes minimize handling costs and either reduce or eliminate the discharge of pollutants. In addition, the pickling operation itself may be made more efficient, since the acid bath can be kept at a relatively constant strength.

The Agency has identified the following recovery and regeneration systems which are presently operated in this country. These systems are available and have been proven effective at many pickling operations.

1. Sulfuric Acid Recovery

The most common treatment method for recovering valuable products from spent sulfuric acid is acid recovery by removing ferrous sulfate through crystallization. Spent pickle liquor, which is high in iron content, is pumped into a crystallizer, where the iron is precipitated (under refrigeration or vacuum) as ferrous sulfate heptahydrate crystals. As the crystals are formed, water is removed and the free acid content of the solution increases to a level where it is reusable in the pickling operation. The crystals are separated from solution, and the recovered acid is pumped back to the pickling tank. The by-product ferrous sulfate heptahydrate is commercially marketable. The crystals are dried, bagged, and marketed, or sold in bulk quantities. Ferrous sulfate, commonly referred to as "copperas," is used in appreciable quantities in numerous industries, including the manufacture of inks, dyes, paints, and fertilizers. It is also used as a coagulant in water and wastewater treatment. See Figures III-5 and III-6 for the two types of available recovery operations. As an added note, recovery processes, which produce ferrous sulfate monohydrate crystals as a by-product are also available. This process is usually carried out at elevated temperatures.

2. Hydrochloric Acid Regeneration

The only commercially proven technology to regenerate spent hydrochloric acid is through thermal decomposition. The spent pickle liquor contains free hydrochloric acid, ferrous chloride, and water. The liquor is heated to remove some of the water through evaporation and to concentrate the solution. The concentrated solution is then further heated to 925° to 1,050°C (1,700° to 1,920°F). At this temperature, water is completely evaporated and the ferrous chloride decomposes into iron oxide (ferric oxide, Fe_2O_3) and hydrogen chloride (HCl) gas. The iron oxide is separated and removed from the system. The hydrogen chloride gas is reabsorbed in water (sometimes rinsewater or scrubber water is used), to produce hydrochloric acid solution (generally from 15% to 21% HCl) which is reused in the pickling operation. There are several types of these "roaster" processes in operation. The basic difference between the processes is the design and operation of the roaster/reactor and the recovery equipment. Each design, however, has its own distinct advantages and disadvantages (see Figures III-7 through III-9).

3. Combination Acid Pickling

The Agency is unaware of any operating nitric or hydrofluoric acid recovery process operating in this country. It has been reported that such a system is installed and successfully operating in the People's Republic of China. However, due to the lack of operating and performance data, the Agency is not basing any of its proposed limitations or standards on this technology.

A summary of the treatment practices in each subdivision for the disposal of spent pickle wastes is listed below:

Acid Subdivision	Central Treatment	Acid Recovery	Contract Hauling	Deep Well	POTW Discharge
Sulfuric	38.3%	2.6%	44.5%	5.2%	9.4%
Hydrochloric	13.7%	8.4%	53.7%	12.6%	11.6%
Combination	46.0%	0%	44.0%	0%	10.0%

Treatment of Fume Scrubber Water

Many pickling lines include wet scrubber systems to control the emission of fumes from the operation. Water is used to scrub the fumes and thus becomes contaminated with the same type of pollutants which are discharged from the other waste sources. The flow rates from the scrubbers can be very large, and if not controlled, will result in the discharge of large pollutant loads.

One means to control the amount of pollutants generated from this source is to install recycle systems. Recycle rates of 100% have been reported for many operations and many others have installed systems which have recycle rates ranging between 90-95% of the total wastewater flow.

High recycle rates are achievable, because corrosion does not present a problem. The scrubbers are normally made of fiberglass, which is not affected by the low pH of this waste source. Therefore, the degree of recycle is limited by the buildup of dissolved solids in the recycle loop. Those operations that do not recycle this waste source discharge these wastes to POTWs or to receiving streams after varying degrees of treatment. The treatment components used by the lines that discharge wastes from their scrubber systems are described below.

General Treatment Configuration for Pickle Rinsewaters

Most of the operations that treat pickle rinsewaters prior to discharge do so in central treatment systems. Some of the wastewaters that are often combined with the pickling wastes are cold rolling wastewaters and wastewaters from alkaline cleaning or kolene and hydride descaling operations. The pickling wastewaters are often combined with cold rolling wastewaters, because the acid in the pickling wastewaters helps break oil emulsions in cold rolling wastewaters. Pickling wastewaters are often treated together with alkaline wastewaters so that they neutralize each other. This can greatly reduce the costs for chemicals necessary for neutralization. In any event, most existing treatment systems have components which accomplish the following: neutralize the acid in the wastes; precipitate dissolved metals out of solution; promote flocculation of solids and metals; and provide sufficient sedimentation for the solids and precipitated metals. Also, some systems include a step which dewaters any sludge generated in the treatment process.

Control and Treatment Technologies Considered for Toxic Pollutant Removal

As the Agency found toxic metal pollutants in significant levels in the discharges from acid pickling operations, it evaluated treatment systems which are designed primarily to remove these pollutants.

The advanced alternative treatment systems considered by the Agency for acid pickling operations are described below. These systems have been demonstrated in varying degrees in the pickling subcategory and in other industrial applications for wastes with characteristics similar to those of acid pickling.

A. Lime Precipitation

Chemical treatment of acid pickling wastewaters is well demonstrated at many plants with lime and polymer flocculation. Lime precipitation is an effective method of removing toxic metal pollutants from the wastewater. Lime precipitation involves the addition of lime, either in the dry or hydrated slurry form, to the wastewater in a mixing tank followed by sedimentation or filtration. The metal precipitates are in the hydroxide form.

Lime is commonly used to neutralize acidic wastes because of economic considerations. Other chemicals such as caustic are considerably more expensive, but in certain applications offer advantages over lime. Good removal efficiencies of metals with lime precipitation have been found in this subcategory. Low effluent levels have also been demonstrated in other steelmaking subcategories that employ lime precipitation.

A final consideration relating to lime precipitation systems is the solid waste generation resulting from its use. The large amounts of sludges which are generated due to the lime addition are generally disposed of by landfilling. The disposal of such sludges may pose an operating problem and result in increased costs, depending on the availability of landfill sites.

The amount of sludge produced during treatment of pickling wastewaters can be minimized by the design of the treatment process. In conventional treatment processes the entire volume of sludge produced is discharged for handling and disposal. In the modified system a portion of the sludge is recycled to the head of the treatment plant to act as seed for the treatment process. The sludges produced in this modified approach are considerably denser than the sludge produced by the conventional process. The sludge volume can be reduced by a factor of 30.

B. Sulfide Precipitation

The addition of sulfide compounds to the wastewaters is capable of reducing metals concentrations below the levels usually achieved in lime precipitation reactions. Some of the metals which can effectively be precipitated with sulfide are zinc, copper, nickel, lead, and silver, which are all toxic metal pollutants. The increased removal efficiencies can be attributed to the comparative solubilities of metallic sulfides with metallic hydroxides.

Iron sulfide is used to achieve precipitation, because this compound has a solubility which exceeds that of the heavy metal sulfides to be precipitated. Also, this compound does not form excessive levels of sulfide ion concentrations, which could contribute to the formation of hydrogen sulfide, an objectionable gas. The typical sulfide precipitation system consists of neutralization, precipitation, and filtration.

There are several problems associated with the sulfide precipitation system which must be taken into consideration: (1) high sludge production (unless the sulfide addition follows a preliminary hydroxide precipitation step); and (2) higher costs than for the standard hydroxide precipitation system, because neutralization of the wastewater prior to sulfide treatment is necessary.

C. Vapor Compression Distillation (Evaporation)

Vapor compression distillation is typically used to concentrate a high dissolved solids waste stream (3,000 - 10,000 mg/l) to a slurry consistency (approximately 100,000 mg/l). The slurry discharge can be dried in a mechanical drier or allowed to crystallize in a small solar or steam-heated pond prior to final disposal. The distillate quality water generated by this system can be recycled back to an acid pickling operation thereby eliminating all discharges. One desirable feature of this system is its relative freedom from scaling. Because of the unique design of the system, calcium sulfate and silicate crystals grow in solution as opposed to depositing on heat transfer surfaces. Economic operation of this system requires a high calcium to sodium ratio (hard water).

The installation of this system may be the only possible way to achieve a zero discharge of process water at all acid pickling operations. However, the high cost and energy intensive nature of this system precludes its widespread use.

Summary of Analytical Data

Raw wastewater and effluent analytical data for the acid pickling operations which were visited are presented by subdivision in Tables VII-2 through VII-14. Table VII-1 provides a key for the control and treatment technology abbreviations used in the tables throughout this report. The concentration values presented in the tables represent, except where footnoted, averages of gross measured values. In some cases these data were obtained from central treatment systems. Spent concentrations, fume scrubber wastewaters, and absorber vent scrubber wastewaters are listed in the raw form only; no effluent values are given. In several instances, the effluent waste loads (lbs/1000 lbs) for certain central treatment operations indicated on the analytical data tables represent apportioned loads. In these central treatment systems, the percentage contribution of an individual operation to the total treatment system influent load is determined and subsequently applied to the total effluent load. This procedure was repeated for each pollutant. By using this procedure, the Agency assessed the effects of treatment on the waste loads of an individual process which discharges to a central treatment facility. Following the determination of the raw and effluent waste loads, the pollutant load reductions accomplished by each operation for each pollutant were then determined.

Summary of Long-Term Analytical Data

As a supplement to the sampled plant analytical data, long-term effluent analytical data from operations responding to the D-DCPs are presented in Volume I.

Plant Visits

Brief descriptions of the visited plants follow. Treatment system flow schematics are provided at the end of this section.

Plant A - See Plant 121

Plant C - Figure VII-1 (Combination)

This plant recently completed the installation of a new central treatment facility. At the time of this sampling inspection, the rinsewaters from bar and plate pickling lines were combined prior to entering an equalization tank. From the equalization tank the wastes were transferred to a mixing tank, where lime and coagulant aids were added. The neutralized wastes then were settled in a sedimentation tank. The discharge was sent to a receiving stream. The spent pickle liquors from the bar and plate lines are discharged to a holding tank, and then are hauled away by a private contractor.

Plant D - Figure VII-2 (Combination)

At the time of the sampling trip, the acid rinses generated by this continuous strip pickling process were discharged to a receiving stream without treatment. However, a central treatment system that treats the wastewaters from this combination acid pickling line was completed in 1978 and is now in operation.

Plant F - Figure VII-3 (Combination)

This plant had two sources of wastes: pickle rinsewater and fume scrubber water, that were combined prior to entering an equalization tank. After equalization, lime is added and the pickling wastes are combined with rolling mill wastes in a scale pit. From the scale pit, the combined wastewater undergoes settling in a settling basin. The spent pickle liquor at this operation is hauled away to a company owned disposal site.

Plant H-2 - Figure VII-4 (Sulfuric)

Dunk rinses are cascaded to minimize flow; spray and other rinses blended with other plant wastewaters for treatment by gas flotation, neutralization with lime or caustic, flocculation with polymers, clarifier, with thickening and vacuum filtration of clarifier underflows. Concentrations are contract hauled off-site.

Plant I - Figure VII-5 (Combination)

This plant employs lime neutralization of the spent pickling solutions,mixing with the acid rinses, and sedimentation in a lagoon to treat this wastewater generated by the strip pickling process.

Plant I-2 - Figure VII-6 (Sulfuric)

Waste pickle liquor is hauled away by a private contractor. All rinses are combined with other plant wastes in a terminal lagoon and discharged to a canal.

Plant I-2 - Figure VII-6 (Hydrochloric)

This plant dilutes pickle liquor and rinses together with other plant wastes in a terminal lagoon and then discharges to a canal.

Plant L - Figure VII-7 (Combination)

This plant employs municipal co-treatment to treat process rinsewaters generated by the batch bar pickling operation. Waste pickle liquors are treated at the plant employing lime neutralization.

Plant O - Figure VII-8 (Combination)

This plant treats its pickle rinsewaters in a central treatment system with wastes from other processes. The pickling wastes comprise 50% of the total flow to the central treatment system. Central treatment consists of equalization, sodium hydroxide neutralization, aeration, and clarification. Sludges are dewatered in a sludge lagoon. Spent pickle liquors at this operation are hauled off-site by a private contractor.

Plant O-2 - Figure VII-9 (Sulfuric)

This plant employs batch evaporative crystallization of spent sulfuric acid. Acid is recovered by the production of ferrous sulfate heptahydrate. Rinses are recycled to process as makeup to pickle tank. Zero discharge is achieved.

Plant P-2 - Figures VII-10 and VII-11 (Sulfuric)

This plant employs batch pickle liquor regeneration by vacuum crystallization. Rinses are metered to the sewer.

Plant Q-2 - Figure VII-12 (Sulfuric)

This plant practices batch pickle acid recovery through the cooling of spent pickle liquor and crystallization of ferrous sulfate heptahydrate. Rinses and mists from the filter are recycled back to the pickle tank. Zero discharge is achieved.

Plant R - Figure VII-13 (Sulfuric)

This plant uses lime neutralization and sludge lagooning to treat spent concentrates and rinses from batch specialty steel pickling operations. There is no discharge from the sludge lagoon.

Plant R-2 - Figure VII-14 (Sulfuric)

Pickle liquor and rinses are combined in an equalization tank; mixed and treated with acetylene sludge; lagooned; and discharged to a receiving stream.

Plant S-2 - Figure VII-15 (Sulfuric)

Concentrated pickle liquor is contract hauled. Standing rinse is reused as makeup to the pickle tank. Running rinse is treated with lime and lagooned. The lagoon overflow is recycled, and the sludge is contract hauled.

Plant T-2 - Figure VII-16 (Sulfuric)

Sulfuric acid is recovered from spent pickle liquor by evaporative concentration. Rinses are cascaded and used as pickle tank makeup. Steam condensate is used as a final product rinse.

Plant U - Figure VII-17 (Combination)

This plant employs batch lime neutralization of the acid rinses after combining the rinses with wastes from a degreasing line. This operation also neutralizes its spent pickle liquor prior to evaporating this waste stream to extinction. The effluent from the batch treatment system is discharged to a receiving stream.

Plant U-2 - Figure VII-18 (Hydrochloric)

The waste pickle liquors and rinsewaters from the batch pickling operations are neutralized in a batch treatment tank by sodium carbonate prior to discharge to a municipal sewerage system.

Plant V-2 - Figure VII-19 (Hydrochloric)

The spent pickle liquor from the batch pickling operations is contract hauled. Rinses are neutralized with sodium hydroxide prior to discharge to a municipal sewerage system.

Plant W-2 - Figure VII-20 (Hydrochloric)

Waste pickle liquor is treated by pyrolytic regeneration of hydrochloric acid. Rinses and fume hood scrubber wastes are diluted and metered to a sewer. Absorber vent scrubber wastes are neutralized with caustic solution prior to discharge to a receiving stream.

Plant X-2 - Figures VII-21 and VII-22 (Hydrochloric)

This plant practices spent acid recovery by hydrochloric acid regeneration. Rinses are diluted and discharged to a receiving stream. Absorber vent scrubber wastes are treated in a clarifier along with other plant wastes.

Plant Y-2 - Figures VII-23 and VII-24 (Hydrochloric)

Spent pickle acid is recovered by pyrolytic regeneration of hydrochloric acid. Rinses and absorber vent scrubber wastes are diluted and discharged to a receiving stream.

Plant Z-2 - Figure VII-25 (Hydrochloric)

Refer to Plant 093.

Plant AA-2 - Figure VII-26 (Hydrochloric)

Refer to Plant 100

Plant BB-2 - Figure VII-27 (Hydrochloric)

Concentrated pickle liquor is disposed of by off-site contract hauling to a regeneration system owned by the same company or in an on-site deep well. Rinses are equalized; mixed with cold rolling wastewaters; neutralized; aerated; treated with polymers; clarified; lagooned; and discharged to a receiving stream. Sludge from the clarifiers is dewatered by vacuum filters prior to transport to a dump.

Plant QQ-2 - Figure VII-28 (Sulfuric)

Spent concentrates and fume scrubber system blowdowns are partially cascaded, blended with other plant wastewaters and treated by chromium reduction; emulsion breaking; polymer addition; neutralization with lime; clarification; and, discharge through a settling lagoon with surface skimming for oil removal.

Plant SS-2 - Figure VII-29 (Sulfuric)

Spent concentrates are collected, equalized, and discharged to a deep well. Fume hood scrubber blowdowns and rinsewaters are combined with all other plant wastes; blended; skimmed; neutralized with lime; aerated; flocculated with polymers; and, transferred to a settling lagoon; from which sludges are treated by cyclones and thickeners.

Plant TT-2 - Figure VII-30 (Sulfuric)

Waste pickle liquors are collected, neutralized, and transferred to off-site evaporation ponds. Rinses are cascaded, blended with fume scrubber blowdowns, and discharged without treatment. A treatment facility is under construction.

Plant WW-2 - Figure VII-31 (Sulfuric)

Spent concentrates are filtered and injected into deep wells. Rinsewaters are blended with other plant wastewaters, flocculated with polymers and alum, neutralized with lime, clarified, skimmed and discharged through a terminal settling lagoon.

Plant 090 - Figure VII-32 (Sulfuric)

Plant treats rinses from batch pipe and tube pickling in a central treatment facility that includes equalization, oil skimming, aeration, neutralization with lime, polymer addition, clarification, and finally, discahrge to a receiving stream. Spent concentrates are recovered by a vacuum crystallization acid recovery system.

Plant 091 - Figure VII-33 (Sulfuric)

Concentrates from a batch rod pickling operation are hauled off-site for disposal. Rinses are blended and equalized with hydrochloric acid pickling and galvanizing wastewaters; aerated; neutralized with lime; clarified; and, filtered prior to discharge.

Plant 091 - Figure VII-33 (Hydrochloric)

Spent pickle liquor and rinses are neutralized with lime, oxidized, clarified, and filtered through pressure sand filters prior to discharge to a receiving stream. Clarifier sludge is dewatered by vacuum filters prior to disposal.

Plant 092 - Figure VII-34 (Sulfuric and Hydrochloric)

Refer to Plant 123.

Plant 093 - Figure VII-35 (Hydrochloric)

Spent pickle liquor and rinses are mixed with galvanizing and cold rolling wastewaters, neutralized and clarified with polymer addition prior to discharge to a municipal sewerage system. Sludges from the clarifier are dewatered by vacuum filtration prior to transport to a landfill.

Plant 094 - Figure VII-36 (Sulfuric)

Spent concentrates hauled off-site; rinses combined with all other finishing mill wastewaters, equalized, skimmed, treated with lime and polymer, clarified via thickener. Centrifugation of underflows and discharge of treated effluents.

Plant 095 - Figures VII-37 and VII-38 (Hydrochloric)

This plant practices spent acid recovery by hydrochloric acid regeneration. Some rinsewater is recycled to fume hood scrubbers and absorber vent scrubbers. Remaining rinsewater and scrubber wastes are sent to waste lagoons.

Plant 096 - Figure VII-39 (Sulfuric)

Batch fastener pickler wastes are blended with galvanizing, aluminizing, and electroplating wastes; aerated and neutralized with lime; thickened; and, filtered. Filtrates are discharged to a holding lagoon for plant-wide reuse or discharge.

Plant 097 - Figure VII-40 (Sulfuric)

Spent concentrates are recovered by a two-stage evaporation and crystallization recovery system designed to produce dry copperas. Cold water rinses are used as pickle tank makeup, while hot rinses are discharged to a POTW for further treatment.

Plant 098 - Figure VII-41 (Sulfuric)

Three lines pickle bar, wire, and special shapes. Rinses are concentrated and dumped to pickle tanks as makeup. Acid vapors are collected by a demister and recycled to pickle tanks. All sumps and foundation drains are collected and transferred to storage. All liquid wastes are contract hauled off-site.

Plant 099 - Figure-42 (Hydrochloric)

The spent pickle liquor is recovered by acid regeneration. Rinses and fume scrubber wastes are mixed with other plant wastes, neutralized and settled in ponds prior to discharge to a receiving stream.

Plant 100 - Figure VII-43 (Hydrochloric)

This plant has cascade rinse systems with the rinsewater used as makeup to a fume scrubber. Spent pickle liquor and fume scrubber wastes are combined with cold rolling wastewaters and disposed of by deep well injection.

Plant 121 and A - Figure VII-44 (Combination)

This operation was visited on two occasions for this study. The first time the operation was designated as Plant A, and for the second sampling trip the operation was designated as Plant 121. The pickle rinse and fume scrubber waters are combined with other small volume waste flows before entering a central treatment system. The pickling wastes comprise approximately 75% of the total wastewater flow entering the central treatment system.

The combined wastes are treated by equalization, neutralizaton and clarification. The underflow from the clarifiers goes to thickeners and centrifuges. The overflow from the clarifiers goes to a polishing tank from which approximately 50% of the treated water is discharged to a receiving stream. The waste pickle liquor is hauled off-site by private contractors.

Plant 122 (Combination)

Due to various technical difficulties not known during sampling, the data from this plant are unacceptable. Therefore, they were disregarded.

Plant 123 - Figure VII-34 (Combination)

The rinsewaters from this combination acid pickling operation (sample point D) are combined with other pickling and hot mill wastes prior to entering a central treatment system. The combined waste stream then undergoes equalization, neutralization with lime, flocculation with polymers, and clarification. Sludges produced are dewatered in vacuum filters. Spent acid solutions are hauled off-site by private contractors.

Plant 125 - Figure VII-45 (Combination)

This operation treats its pickle rinse and fume hood scrubber blowdown water in a three-compartment lime neutralization pit prior to discharging these wastes to a POTW.

TABLE VII-1

OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS

Symbols

A. Operating Modes

1. OT Once-Through

2. Rt,s,n Recycle, where t = type waste
s = stream recycled
n = % recycled

t: U = Untreated
T = Treated

	s	n
P	Process Wastewater	% of raw waste flow
F	Flume Only	% of raw waste flow
S	Flume and Sprays	% of raw waste flow
FC	Final Cooler	% of FC flow
BC	Barometric Cond.	% of BC flow
VS	Abs. Vent Scrub.	% of VS flow
FH	Fume Hood Scrub.	% of FH flow

3. REt,n Reuse, where t = type
n = % of raw waste flow

t: U = before treatment
T = after treatment

4. BDn Blowdown, where n = discharge as % of raw waste flow

B. Control Technology

10. DI Deionization

11. SR Spray/Fog Rinse

12. CC Countercurrent Rinse

13. DR Drag-out Recovery

C. Disposal Methods

20. H Haul Off-Site

21. DW Deep Well Injection

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS
PAGE 2

C. Disposal Methods (cont.)

22.	Qt,d	Coke Quenching, where t = type d = discharge as % of makeup t: DW = Dirty Water CW = Clean Water
23.	EME	Evaporation, Multiple Effect
24.	ES	Evaporation on Slag
25.	EVC	Evaporation, Vapor Compression Distillation

D. Treatment Technology

30.	SC	Segregated Collection
31.	E	Equalization/Blending
32.	Scr	Screening
33.	OB	Oil Collecting Baffle
34.	SS	Surface Skimming (oil, etc.)
35.	PSP	Primary Scale Pit
36.	SSP	Secondary Scale Pit
37.	EB	Emulsion Breaking
38.	A	Acidification
39.	AO	Air Oxidation
40.	GF	Gas Flotation
41.	M	Mixing
42.	Nt	Neutralization, where t = type t: L = Lime C = Caustic A = Acid W = Wastes O = Other, footnote

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS
PAGE 3

D. Treatment Technology (cont.)

43.	FLt	Flocculation, where t = type t: L = Lime A = Alum P = Polymer M = Magnetic O = Other, footnote
44.	CY	Cyclone/Centrifuge/Classifier
44a.	DT	Drag Tank
45.	CL	Clarifier
46.	T	Thickener
47.	TP	Tube/Plate Settler
48.	SLn	Settling Lagoon, where n = days of retention time
49.	BL	Bottom Liner
50.	VF	Vacuum Filtration (of e.g., CL, T, or TP underflows)
51.	Ft,m,h	Filtration, where t = type m = media h = head

t	m	h
D = Deep Bed	S = Sand	G = Gravity
F = Flat Bed	O = Other, footnote	P = Pressure

52.	CLt	Chlorination, where t = type t: A = Alkaline B = Breakpoint
53.	CO	Chemical Oxidation (other than CLA or CLB)

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT
TECHNOLOGIES AND DISPOSAL METHODS
PAGE 4

D. Treatment Technology (cont.)

54. BOt Biological Oxidation, where t = type

    t: An = Activated Sludge
    n = No. of Stages
    T = Trickling Filter
    B = Biodisc
    O = Other, footnote

55. CR Chemical Reduction (e.g., chromium)

56. DP Dephenolizer

57. ASt Ammonia Stripping, where t = type

    t: F = Free
    L = Lime
    C = Caustic

58. APt Ammonia Product, where t = type

    t: S = Sulfate
    N = Nitric Acid
    A = Anhydrous
    P = Phosphate
    H = Hydroxide
    O = Other, footnote

59. DSt Desulfurization, where t = type

    t: Q = Qualifying
    N = Nonqualifying

60. CT Cooling Tower

61. AR Acid Regeneration

62. AU Acid Recovery and Reuse

63. ACt Activated Carbon, where t = type

    t: P = Powdered
    G = Granular

64. IX Ion Exchange

65. RO Reverse Osmosis

66. D Distillation

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT
TECHNOLOGIES AND DISPOSAL METHODS
PAGE 5

D. Treatment Technology (cont.)

67.	AA1	Activated Alumina
68.	OZ	Ozonation
69.	UV	Ultraviolet Radiation
70.	CNTt,n	Central Treatment, where t = type n = process flow as % of total flow t: 1 = Same Subcats. 2 = Similar Subcats. 3 = Synergistic Subcats. 4 = Cooling Water 5 = Incompatible Subcats.
71.	On	Other, where n = Footnote number
72.	SB	Settling Basin
73.	AE	Aeration
74.	PS	Precipitation with Sulfide

TABLE VII-2

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - BATCH PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS

Raw Wastewater

Plant Code	I-2(1)		I-2(2)		O-2		P-2		Q-2	
Reference No.	0856P		0856P		0590		0312		0894	
Sample Points	7		3		1		1		3	
Flow (gal/ton)	207		465		18		16.9		8.0	
Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Dissolved Iron	350	0.302	36	0.070	43,000	3.23	6,500	0.459	3,500	0.117
Suspended Solids	113	0.0977	65	0.12	18	0.0014	749	0.0528	20	0.00067
Oil and Grease	4.3	0.0037	14.4	0.028	12	0.00091	11	0.00078	0.6	0.00002
pH, Units	2.4-2.6	-	2.9-6.4	-	<1.0	-	1.3-1.6	-	1.9	-
115 Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
118 Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
119 Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
120 Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
122 Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
124 Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
128 Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Effluents

Treatment Tech.	SL		SL		AU		None		AU	
Plant Code	I-2(1)		I-2(2)		O-2		P-2		Q-2	
Reference No.	0856P		0856P		0590		0312		0894	
Sample Points	7/(7+3+2+4) 5		3/(7+3+2+4) 5		-		1		-	
Streams Treated	Rinses		Rinses		Rinses & Concentrates		Rinses		Rinses & Concentrates	
Flow (gal/ton)	207		465		0		16.9		0	
Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Dissolved Iron	0.03	0.0018	0.03	0.00041	Zero Discharge		Direct Discharge to POTW		Zero Discharge	
Suspended Solids	39	0.023	39	0.029						
Oil and Grease	14	0.0068	14	0.0516						
pH, Units	6.7	-	6.7	-						
115 Arsenic	NA	NA	NA	NA						
118 Cadmium	NA	NA	NA	NA						
119 Chromium	NA	NA	NA	NA						
120 Copper	NA	NA	NA	NA						
122 Lead	NA	NA	NA	NA						
124 Nickel	NA	NA	NA	NA						
128 Zinc	NA	NA	NA	NA						

TABLE VII-2
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - BATCH PROCESS
GROSS RAW AND EFFLUENT WASTEWATER - CONCENTRATIONS AND LOADS
PAGE 2

Raw Wastewater

	Plant Code	R-2		S-2		R		090		091	
	Reference No.	0240B		0256G		0240A		0476A		0612	
	Sample Points	2-7-6		3-4		11		C		F	
	Flow (gal/ton)	30.8		198		30		91		122	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	1850	0.238	596	0.491	8990	1.126	395	0.150	2350	1.20
	Suspended Solids	3688	0.474	159	0.131	1.3	0.00016	10	0.0038	96	0.0092
	Oil and Grease	665	0.0855	21	0.017	1.3	0.00016	26	0.0099	18	0.049
	pH, Units	2.0	-	2.2	-	1.6	-	1.7-2.5	-	1.8	-
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
118	Cadmium	NA	NA	NA	NA	NA	NA	*	Neg	0.020	0.000010
119	Chromium	NA	NA	NA	NA	NA	NA	0.37	0.00014	3.8	0.0019
120	Copper	NA	NA	NA	NA	NA	NA	0.39	0.00015	0.63	0.00032
122	Lead	NA	NA	NA	NA	NA	NA	*	Neg	0.21	0.00011
124	Nickel	NA	NA	NA	NA	NA	NA	0.44	0.00017	0.80	0.00041
128	Zinc	NA	NA	NA	NA	NA	NA	59	0.022	27	0.014

Effluents

	Treatment Tech.	SL, E		None		SL, ML		E, AE, ML, CL, FLP		E, ML, CL, FDS	
	Plant Code	R-2		S-2		R		090		091	
	Reference No.	0240B		0256G		0240A		0476A		0612	
	Sample Points	(2-7-6)/(2+9) 3		-		-		(C/E)C		F/(B+C+D+E) H	
	Streams Treated	Rinses		Rinses		Rinses & Concentrates		Rinses		Rinses & Concentrates	
	Flow (gal/ton)	30.8		0		0		9.1		122	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	0.04	Neg	Complete		Complete		0.050	0.00012	0.37	0.0086
	Suspended Solids	82	0.000057	Recycle		Impoundment		4	0.000066	11	0.00066
	Oil and Grease	9	Neg	Operation		via		11	0.0040	4	0.0038
	pH, Units	11.4	-			Lagoons		6.6-9.0		8.3-8.5	
115	Arsenic	NA	NA					NA	NA	NA	NA
118	Cadmium	NA	NA					*	Neg	0.020	0.000085
119	Chromium	NA	NA					*	Neg	0.04	0.00059
120	Copper	NA	NA					0.030	0.000030	0.03	0.00110
122	Lead	NA	NA					*	Neg	0.19	0.000010
124	Nickel	NA	NA					0.030	0.000034	0.03	0.00026
128	Zinc	NA	NA					0.060	0.00030	0.13	0.000070

TABLE VII-2
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - BATCH PROCESS
GROSS RAW AND EFFLUENT WASTEWATER - CONCENTRATIONS AND LOADS
PAGE 3

Raw Wastewater

	Plant Code	092		096		098			
	Reference No.	0088A		0112I		0684D			
	Sample Points	F-D		D		B		Average	
	Flow (gal/ton)	326		604		12.2		248	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	51.7	0.0704	97	0.24	2900	0.15	5432	0.603
	Suspended Solids	361	0.492	127	0.320	32	0.00020	418	0.131
	Oil and Grease	42.8	0.0582	16	0.040	4	0.0016	64.3	0.022
	pH, Units	5.9-6.9	-	3.2-3.7	-	1.8	-	1.0-6.4	-
115	Arsenic	0.39	0.00053	NA	NA	0.34	0.000017	0.37	0.00027
118	Cadmium	3.96	0.0054	*	Neg	0.14	Neg	0.83	0.0011
119	Chromium	16.3	0.022	0.100	0.00025	4.8	0.00024	5.07	0.0049
120	Copper	0.74	0.0010	0.200	0.00050	4.1	0.00021	1.21	0.00064
122	Lead	ND	ND	0.019	0.00048	2.06	0.00011	0.49	0.00014
124	Nickel	1.4	0.0019	0.090	0.00023	7.5	0.00038	2.05	0.00062
128	Zinc	3.9	0.0053	15	0.038	1.3	0.000066	21.2	0.016

Effluents

	Treatment Tech.	E,CR,NL,FLP,CL,T,VF		AE,NL,CL,F,		-	
	Plant Code	092		096		098	
	Reference No.	0088A		0112I		0684D	
	Sample Points	(F-D)/(F+G+H) I		D(F+B) H		-	
	Streams Treated	Rinses		Rinses		-	
	Flow (gal/ton)	326		604		12.2	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	0.45	0.00095	0.05	0.00031		
	Suspended Solids	29	0.00177	1	0.0028	No treatment on-site.	
	Oil and Grease	9	0.00068	4	0.0026	Rinses used as make-up	
	pH, Units	7.5-8.3	-	7.3	-	and all wastewaters hauled off-site.	
115	Arsenic	0.010	0.000030	NA	NA		
118	Cadmium	0.010	0.000032	*	Neg		
119	Chromium	0.36	0.00070	*	Neg		
120	Copper	0.04	0.000076	0.020	0.000096		
122	Lead	*	Neg	0.10	0.00035		
124	Nickel	0.33	0.00016	0.08	0.00014		
128	Zinc	0.012	0.00034	0.13	0.00049		

TABLE VII-2
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - BATCH PROCESS
GROSS RAW AND EFFLUENT WASTEWATER - CONCENTRATIONS AND LOADS
PAGE 4

FOOTNOTES

NA : Not analyzed.
ND : Not detected.
Neg: Calculated wasteload <0.000010 lbs/1000 lbs.
* : Concentrations <0.010 mg/l.
- : Negative results were obtained when contributing streams are subtracted from the stream.

Treatment Tech. Code

AE : Aeration
AU : Acid recovery
CC : Countercurrent rinse
CR : Chemical reduction
E : Equalization
F : Filtration
FLP : Flocculation with polymer
FDBS: Filtration - Deep Bed Sand
NA : Not analyzed
NL : Neutralization with Lime
CL : Sedimentation via clarifier
SL : Sedimentation via lagoon
T : Sedimentation via thickener
VF : Vacuum filtration

(1) No. 4 pickling operation
(2) No. 5 pickling operation

TABLE VII-3

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - BATCH PROCESS
GROSS RAW SPENT CONCENTRATES - CONCENTRATIONS AND LOADS

Raw Wastewater

	Plant Code	P-2		Q-2		R-2		091		092			
	Reference No.	0312		0894		0240B		0612		0088A			
	Sample Points	3		1		6		R		C		Average	
	Flow (gal/ton)	17.6		24.3		10.5		3.5		14.6		14.1	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	46,800	2.93	61,900	6.27	67,800	2.97	63,000	0.921	38,500	2.38	55,600	3.09
	Suspended Solids	26.0	0.00016	1420	0.144	70	0.0031	2520	0.837	306	0.187	868	0.234
	Oil & Grease	NA	0.00018	14	0.0014	NA	NA	11	0.00016	17	0.0010	15.3	0.00069
	pH	1.4	-	<1	-	2.0	-	<1	-	<1	-	<1-2.0	
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	0.17	0.000010	0.17	0.000010
118	Cadmium	NA	NA	NA	NA	NA	NA	0.26	Neg.	0.28	0.000017	0.27	Neg.
119	Chromium	NA	NA	NA	NA	NA	NA	269	0.00393	205	0.0725	237	0.0082
120	Copper	NA	NA	NA	NA	NA	NA	2.6	0.000038	4.7	0.00029	3.7	0.00016
122	Lead	NA	NA	NA	NA	NA	NA	1.6	0.000023	*	Neg.	0.81	0.000012
124	Nickel	NA	NA	NA	NA	NA	NA	23	0.00034	27.0	0.0016	25	0.00097
128	Zinc	NA	NA	NA	NA	NA	NA	16	0.00023	133	0.0087	74.5	0.0042

NA : Not analyzed
Neg.: Wasteload less than 0.000010 lbs/1000 lbs
* : Concentration is less than 0.010 mg/l

TABLE VII-4

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS

Raw Wastewater

Plant Code	H-2$^{(1)}$		H-2$^{(2)}$		T-2		QQ-2		SS-2	
Reference No.	0432A		0432A		0792B		0584E		0112A	
Sample Points	3		4		1		5		2	
Flow (gal/ton)	103		11.5		21.6		167		202	
Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Dissolved Iron	55	0.024	0.02	Neg.	1833	0.165	83	0.058	63	0.053
Suspended Solids	28	0.012	20	0.00096	49	0.0044	35	0.024	76	0.064
Oil and Grease	11	0.0047	11	0.00053	5.0	0.00045	2	0.0014	2	0.002
pH, Units	1.9	-	6.4	-	1.6	-	2.7	-	2	-
115 Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
118 Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
119 Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
120 Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
122 Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
124 Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
128 Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Effluents

Treatment Tech.	FLL, ML, FLP, CL, T, VF		FLL, ML, FLP, CL, T, VF		None		CR, CC, EB, ML, CL, SL		ML, AE, FLP, T, SL, SS	
Plant Code	H-2$^{(1)}$		H-2$^{(2)}$		T-2		QQ-2		SS-2	
Reference No.	0432A		0432A		0792B		0584E		0112A	
Sample Points	-		-		-		5/(6+2) 7		1/(1+2+7) 9	
Streams Treated	Rinses		Rinses		Rinses		Concentrates & Rinses		Rinses & Fume Hood Scrubber	
Flow (gal/ton)	103		11.5		0		167		202	
Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Dissolved Iron	Direct Discharge to Terminal Treatment Where No Samples Were Taken		Direct Discharge to Terminal Treatment Where No Samples Were Taken		Complete Recycle System		0.04	Neg.	0.04	0.0003
Suspended Solids							1	0.00015	43	0.014
Oil & Grease							3	0.000056	6	0.00021
pH, Units							7.5	-	7.7	-
115 Arsenic							NA	NA	NA	NA
118 Cadmium							NA	NA	NA	NA
119 Chromium							NA	NA	NA	NA
120 Copper							NA	NA	NA	NA
122 Lead							NA	NA	NA	NA
124 Nickel							NA	NA	NA	NA
128 Zinc							NA	NA	NA	NA

TABLE VII-4
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS
PAGE 2

Raw Wastewater

	Plant Code	TT-2		WW-2		094[(3)]		094[(4)]		097			
	Reference No.	0856D		0868A		0948C		0948C		0760			
	Sample Points	1		1		C		D		E+B		Average	
	Flow (gal/ton)	134		286		303		422		11.1		166	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	81.9	0.0458	357	0.423	40	0.051	98	0.17	29,780	1.38	6071	0.414
	Suspended Solids	7.0	0.0039	6.1	0.0072	38	0.048	37	0.065	501	0.0232	118	0.029
	Oil and Grease	2.4	0.0013	1.6	0.0019	9	0.011	14	0.025	33.4	0.00155	12.1	0.0082
	pH, Units	1.8	-	1.7	-	3.2-5.7	-	2.2-2.3	-	NA	-	1.7-5.7	-
115	Arsenic	NA	NA	NA	NA	*	0.000013	*	0.000018	0.17	Neg.	0.064	0.000010
118	Cadmium	NA	NA	NA	NA	*	0.000013	*	0.000018	0.302	0.000014	0.107	0.000014
119	Chromium	NA	NA	NA	NA	*	0.000013	0.05	0.000088	2.0	0.000093	0.687	0.000005
120	Copper	NA	NA	NA	NA	0.055	0.000070	0.14	0.00025	2.4	0.000111	0.865	0.00014
122	Lead	NA	NA	NA	NA	0.04	0.000051	*	0.000018	1.0	0.000048	0.35	0.000039
124	Nickel	NA	NA	NA	NA	0.06	0.000076	0.011	0.000019	13.8	0.00064	4.62	0.00025
128	Zinc	NA	NA	NA	NA	0.04	0.000051	0.09	0.00010	1.8	0.000085	0.64	0.000099

Effluents

	Treatment Tech.	Evaporation Pond		FLP, FLA, ML, CL, SS, SL		E, SS, T, FLP, ML		E, FLP, SS, T, ML		Evaporation, Crystallization	
	Plant Code	T-2		WW-2		094[(3)]		094[(4)]		097	
	Reference No.	0856D		0868A		0948C		0948C		0760	
	Sample Points	-		(1/4)5		(C/G)H		(D/G)H		F+G	
	Streams Treated	Rinses, & Fume Hood Scrubbers		Rinses		Rinses		Rinses		Rinses	
	Flow (gal/ton)	134		286		303		422		11.0	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	Direct Discharge to Receiving Stream		0.17	0.0007	0.050	0.000040	0.050	0.0003	465	0.0834
	Suspended Solids			15	0.0006	6	0.00047	6	0.0013	7.5	0.00131
	Oil and Grease			8.5	0.00007	6	0.00047	6	0.00091	9.3	0.0017
	pH, Units			8.0	-	7.6-7.8	-	7.6-7.8	-	NA	-
115	Arsenic			NA	NA	*	0.000013	*	0.000018	0.010	Neg.
118	Cadmium			NA	NA	*	0.000013	*	0.000018	0.012	Neg.
119	Chromium			NA	NA	0.020	0.000013	0.020	0.000053	ND	ND
120	Copper			NA	NA	*	ND	*	0.000018	0.139	0.000025
122	Lead			NA	NA	*	0.000051	*	0.000018	0.040	Neg.
124	Nickel			NA	NA	0.040	0.000051	0.040	0.000018	0.094	0.000017
128	Zinc			NA	NA	0.070	0.000020	0.070	0.000062	0.059	0.000011

TABLE VII-4
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS
PAGE 3

FOOTNOTES

(1) Spray Rinse
(2) Cascade Rinse
(3) Sheet Pickling Operation
(4) Strip Pickling Operation

ND : Not detected
NA : Not analyzed
Neg.: Wasteload is less than 0.000010 lbs/1000 lbs
* : Concentration is less than 0.010 mg/l.

Treatment Tech Code

AE : Aeration
CC : Countercurrent rinse
CR : Chemical reduction
E : Equalization
EB : Emulsion breaking
FLA: Flocculation with alum
FLL: Flocullation with lime

FLP: Flocculation with polymer
NL : Neutralization with lime
CL : Sedimentation via clarifier
SS: Skimming
SL : Sedimentation via lagoon
T : Sedimentation via thickener
VF : Vacuum filtration

TABLE VII-5

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW SPENT CONCENTRATES - CONCENTRATIONS AND LOADS

Raw Wastewater										
Plant Code	H-2		T-2*		QQ-2		SS-2		TT-2	
Reference No.	0432A		0792B		0584E		0112A		0856D	
Sampling Points	2				2		1		4	
Flow (gal/ton)	14.7		14.6		23.6		10.9		23	
Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Dissolved Iron	47,900	2.93	34,000	2.07	48,300	4.76	48,000	2.18	70,800	6.8
Suspended Solids	17,000	1.04	65	0.0040	128	0.126	200	0.0091	222	0.0213
Oil & Grease	NA	NA	18	0.0011	8.5	0.008	9.5	0.00043	18.5	0.00178
pH	<1	-	<1	-	<1	-	<1	-	<1	-
115 Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
118 Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
119 Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
120 Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
122 Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
124 Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
128 Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Raw Wastewater						
Plant Code	WW-2		097			
Reference No.	0868A		0760			
Sampling Points	2		E		Average Flow	
Flow (gal/ton)	44.7		7.2		19.8	
Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	Average mg/l	Average lbs/1000 lbs
Dissolved Iron	19,000	3.55	46,000	1.4	44,860	3.4
Suspended Solids	91	0.0170	320	0.0096	2,575	0.175
Oil & Grease	10	0.00187	46	0.0014	18	0.0012
pH	<1	-	<1	-	<1	-
115 Arsenic	NA	NA	0.18	Neg	0.18	Neg
118 Cadmium	NA	NA	0.46	0.000014	0.46	0.000014
119 Chromium	NA	NA	30.0	0.00090	30.0	0.00090
120 Copper	NA	NA	3.0	0.000090	3.0	0.000090
122 Lead	NA	NA	1.6	0.000048	1.6	0.000048
124 Nickel	NA	NA	21	0.00063	21	0.00067
128 Zinc	NA	NA	2.8	0.000084	2.8	0.000084

NA : Not analyzed.
Neg: Wasteload value is less than 0.000010 lbs/1000 lbs.
* : Acid Recovery plant with zero discharge.

TABLE VII-6

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
SULFURIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW FUME HOOD SCRUBBER WASTEWATER - CONCENTRATIONS AND LOADS

Raw Wastewater									
Plant Code		QQ-2		SS-2		TT-2			
Reference No.		0584E		0112A		856D		Average Flow	
Sample Points		3		3+4+5		2		9.0	
Flow (gal/ton)		2		22.6		2.3			
Parameter		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	Average mg/l	Average lbs/1000 lbs
	Dissolved Iron	305	0.00255	0.55	0.000052	88.7	0.000852	131	0.00115
	Suspended Solids	2.5	0.000021	7.5	0.00071	198	0.00190	69.3	0.00088
	Oil and Grease	2.5	0.000021	2	0.0019	9.0	0.000086	4.5	0.000099
	pH, Units	1.4	-	1.9	-	1.7	-	1.4-1.9	-
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA
118	Cadmium	NA	NA	NA	NA	NA	NA	NA	NA
119	Chromium	NA	NA	NA	NA	NA	NA	NA	NA
120	Copper	NA	NA	NA	NA	NA	NA	NA	NA
122	Lead	NA	NA	NA	NA	NA	NA	NA	NA
124	Nickel	NA	NA	NA	NA	NA	NA	NA	NA
128	Zinc	NA	NA	NA	NA	NA	NA	NA	NA

NA: Not analyzed

TABLE VII-7

SUMMARY OF ANALYTCIAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - BATCH PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS

Raw Wastewater

	Plant Code	U-2		V-2			
	Reference No.	0480A		0936			
	Sampling Points	1		1+6		Average	
	Flow (gal/ton)	92.9		167.2		130.1	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	190	0.074	270	0.188	230	0.131
	Suspended Solids	0	0	0	0	0	0
	Oil and Grease	3	0.0012	1.5	0.0010	2.3	0.0011
	pH, Units	1.8	-	2.5-3.4	-	1.6-3.4	-
23	Chloroform	NA	NA	NA	NA	NA	NA
114	Antimony	NA	NA	NA	NA	NA	NA
115	Arsenic	NA	NA	NA	NA	NA	NA
118	Cadmium	NA	NA	NA	NA	NA	NA
119	Chromium	NA	NA	NA	NA	NA	NA
120	Copper	NA	NA	NA	NA	NA	NA
122	Lead	NA	NA	NA	NA	NA	NA
124	Nickel	NA	NA	NA	NA	NA	NA
126	Silver	NA	NA	NA	NA	NA	NA
128	Zinc	NA	NA	NA	NA	NA	NA

TABLE VII-7
SUMMARY OF ANALYTCIAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - BATCH PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS
PAGE 2

Effluents

	Treatment Technology	No(1)		AE, NC	
	Plant Code	U-2		V-2	
	Reference No.	0480A		0936	
	Sampling Points	-		4	
	Streams Treated	Rinses		Rinses	
	Flow (gal/ton)	92.9		167.2	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000
	Dissolved Iron	0.50	0.00020	261	0.182
	Suspended Solids	385	0.149	195	0.136
	Oil and Grease	5	0.00194	13	0.009
	pH, Units	8.5	-	3.4-4.5	-
23	Chloroform	NA	NA	NA	NA
114	Antimony	NA	NA	NA	NA
115	Arsenic	NA	NA	NA	NA
119	Chromium	NA	NA	NA	NA
120	Copper	NA	NA	NA	NA
122	Lead	NA	NA	NA	NA
124	Nickel	NA	NA	NA	NA
126	Silver	NA	NA	NA	NA
128	Zinc	NA	NA	NA	NA

NA: Not analyzed.
(1) Neutralized with Soda Ash.

TABLE VII-8

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - BATCH PROCESS
GROSS RAW SPENT CONCENTRATES - CONCENTRATIONS AND LOADS

	Raw Wastewater						
	Plant Code	U-2		V-2			
	Reference No.	0480A		0936			
	Sampling Points	3		7+8		Average Flow	
	Flow (gal/ton)	6.45		3.86		5.16	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	Average mg/l	Average lbs/1000 lbs
	Dissolved Iron	77,000	2.06	107,000	1.72	92,000	1.89
	Suspended Solids	40	0.0108	140	0.0022	90	0.0065
	Oil and Grease	NA	NA	NA	NA	NA	NA
	pH, Units	<1	-	<1	-	<1	-
23	Chloroform	NA	NA	NA	NA	NA	NA
114	Antimony	NA	NA	NA	NA	NA	NA
115	Arsenic	NA	NA	NA	NA	NA	NA
118	Cadmium	NA	NA	NA	NA	NA	NA
119	Chromium	NA	NA	NA	NA	NA	NA
120	Copper	NA	NA	NA	NA	NA	NA
122	Lead	NA	NA	NA	NA	NA	NA
124	Nickel	NA	NA	NA	NA	NA	NA
126	Silver	NA	NA	NA	NA	NA	NA
128	Zinc	NA	NA	NA	NA	NA	NA

NA: Not analyzed.

TABLE VII-9

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW & EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS

Raw Wastewater

	Plant Code	I-2		W-2		X-2		Y-2		Z-2	
	Reference No.	0856P		**		0060B		**		0396D	
	Sampling Points	4		7		3		5		1	
	Flow (gal/ton)	220		228		663		87.3		166	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dis. Iron	7	0.0064	136	0.129	193	0.054	220	0.0802	11300	7.83
	Sus. Solids	96	0.088	20	0.019	9	0.025	7	0.0026	72	0.050
	Oil & Grease	3.9	0.0036	14.8	0.014	ND	ND	3	0.0011	9	0.006
	pH, Units	4.5-5.0	-	2.9-3.8	-	2.2-2.6	-	1.7	-	1.1	-
023	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
114	Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
118	Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
119	Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
120	Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
122	Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
124	Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
126	Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
128	Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

**: Plant has no reference number.

TABLE VII-9
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW & EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS
PAGE 2

Effluents

Treatment Tech.		SL		None		None		None		E, CL, NL, VF
Plant Code		I-2		W-2		X-2		Y-2		Z-2
Reference No.		0856P		-		0060B		-		0396D
Sampling Points		5		None		None		None		2
Streams Treated		Rinses		None		None		None		Rinses & Concentrates
Flow (gal/ton)		220		228		663		87.3		166
	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
Dis. Iron	0.03	(1)	Discharge to POTW without treatment		Direct Discharge without treatment		Discharge to POTW without treatment		0.23	0.000162
Sus. Solids	41	(1)							36	0.0249
Oil & Grease	14	(1)							1	0.00069
pH, Units	6.7	-							8.1-8.6	-
023 Chloroform	NA	NA							NA	NA
114 Antimony	NA	NA							NA	NA
115 Arsenic	NA	NA							NA	NA
118 Cadmium	NA	NA							NA	NA
119 Chromium	NA	NA							NA	NA
120 Copper	NA	NA							NA	NA
122 Lead	NA	NA							NA	NA
124 Nickel	NA	NA							NA	NA
126 Silver	NA	NA							NA	NA
128 Zinc	NA	NA							NA	NA

TABLE VII-9
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW & EFFLUENT RINSE WASTEWATERS - CONCENTRATIONS AND LOADS
PAGE 3

Raw Wastewater

Plant Code	AA-2		BB-2		091		093		095(2)	
Reference No.	0384A		0060		0612		0396D		0584F	
Sampling Points	2		5		B-G-F		B&J		G+GA2+GA3	
Flow (gal/ton)	5.85		211		328		234		24.7	
	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
Dis. Iron	14000	0.342	1100	0.969	+	+	3539	3.46	1591	0.164
Sus. Solids	21	0.00051	37	0.033	120	0.102	491	0.480	46.7	0.048
Oil & Grease	40	0.00098	59	0.052	+	+	249	0.243	2.8	0.00029
pH, Units	1.1	-	1.5-1.7	-	2.9-3.9	-	1.0	-	1.4-1.7	-
023 Chloroform	NA	NA	NA	NA	+	+	*	Neg	0.03	Neg
114 Antimony	NA	NA	NA	NA	ND	ND	NA	NA	0.13	0.000014
115 Arsenic	NA	NA	NA	NA	ND	ND	0.045	0.000044	0.16	0.000016
118 Cadmium	NA	NA	NA	NA	*	Neg	*	Neg	0.14	0.000014
119 Chromium	NA	NA	NA	NA	-	-	0.79	0.00075	0.035	Neg
120 Copper	NA	NA	NA	NA	0.20	0.00017	0.69	0.00067	0.633	0.000065
122 Lead	NA	NA	NA	NA	23.7	0.020	0.43	0.00041	0.42	0.000052
124 Nickel	NA	NA	NA	NA	0.126	0.00011	0.48	0.00043	0.035	Neg
126 Silver	NA	NA	NA	NA	NA	NA	0.027	0.000026	0.17	0.000018
128 Zinc	NA	NA	NA	NA	162	0.137	1.52	0.00149	0.42	0.000043

TABLE VII-9
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW & EFFLUENT WASTEWATERS CONCENTRATIONS AND LOADS
PAGE 4

Effluent

	Treatment Tech.	None		AE,FLP,CL,VF,SL,E		NL,,FDS,VF,CL		NL,CL,VF,E		None	
	Plant Code	AA-2		BB-2		091		093		095	
	Reference No.	0384A		0060		0612		396D		0584F	
	Sampling Points	None		6(3)		$\frac{(B-C-F)}{(B+E+C+D)}$ H		$\frac{(J+B)}{(D+B+F+J+E)}$ A		None	
	Streams Treated	None		Rinses		Rinses & Concentrations		Rinses & Fume Hood Scrubber		None	
	Flow (gal/ton)	5.85		211		328		234		24.7	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dis. Iron	Disposed		0.004	(1)	0.365	0.00030	5.1	0.00073		
	Sus. Solids	via deep		2	(1)	11	0.0111	43.0	0.0156	Discharge to	
	Oil & Grease	well		3	(1)	4	0.00076	5.5	0.0085	waste lagoons	
	pH, Units	injection		8.3-8.9	-	8.4	-	9.1	-	with no	
023	Chloroform			NA	NA	*	+	*	Neg	treatment	
114	Antimony			NA	NA	NA	NA	NA	NA		
115	Arsenic			NA	NA	NA	NA	*	0.000011		
118	Cadmium			NA	NA	0.02	0.000055	0.02	0.000053		
119	Chromium			NA	NA	0.04	Neg	0.075	0.0010		
120	Copper			NA	NA	0.03	0.000075	0.17	0.000092		
122	Lead			NA	NA	0.19	0.0016	0.58	0.000030		
124	Nickel			NA	NA	0.03	0.000066	0.27	0.00017		
126	Silver			NA	NA	0.03	0.000080	0.09	0.000071		
128	Zinc			NA	NA	0.03	0.00041	0.25	0.000023		

TABLE VII-9
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW & EFFLUENT WASTEWATERS CONCENTRATIONS AND LOADS
PAGE 5

Raw Wastewater

	Plant Code	099		100			
	Reference No.	0528B		0384F			
	Sampling Points	C+E		C		Average	
	Flow (gal/ton)	215.6		37.6		202	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dis. Iron	409	0.37	35.0	0.0055	2710	1.15
	Sus. Solids	56.8	0.051	54.0	0.0085	92.8	0.078
	Oil & Grease	7.8	0.0070	8.0	0.0013	33.1	0.0274
	pH, Units	NA	-	4.2	-	1.1-5.0	-
023	Chloroform	*	Neg	0.011	Neg	0.012	Neg
114	Antimony	NA	NA	0.10	0.000016	0.076	0.000010
115	Arsenic	0.063	0.000056	NA	NA	0.067	0.000029
118	Cadmium	*	Neg	*	Neg	0.034	0.000003
119	Chromium	0.85	0.00076	0.030	Neg	0.341	0.00030
120	Copper	0.47	0.00043	0.060	Neg	0.41	0.000267
122	Lead	0.10	0.000090	0.050	Neg	4.94	0.0041
124	Nickel	0.64	0.00057	0.020	Neg	0.26	0.00022
126	Silver	0.02	0.000018	0.020	Neg	0.059	0.000016
128	Zinc	0.60	0.00054	0.14	0.000016	32.9	0.028

TABLE VII-9
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW & EFFLUENT WASTEWATERS CONCENTRATIONS AND LOADS
PAGE 6

Effluents

	Treatment Tech	AR,NL,SL		CL	
	Plant Code	099		100	
	Reference No.	0528B		0384A	
	Sampling Points	$\frac{(C+E)}{(C+E+D+N)}$ G		(C/G) I	
	Streams Treated	Rinses, Fume Hood Scrubber & Adsorber Vent Scrubber		Rinses	
	Flow (gal/ton)	215.6		37.6	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dis. Iron	0.19	0.00024	15.7	0.0177
	Sus. Solids	11.0	0.0128	20.0	0.0021
	Oil & Grease	15.5	0.0144	3.0	0.000077
	pH, Units	7.0	-	8.2	-
023	Chloroform	ND	ND	0.024	Neg
114	Antimony	NA	NA	0.10	Neg
115	Arsenic	*	0.000013	NA	NA
118	Cadmium	*	0.000013	*	Neg
119	Chromium	0.03	0.000015	0.03	Neg
120	Copper	0.025	0.000071	0.02	Neg
122	Lead	0.10	Neg	0.05	Neg
124	Nickel	0.03	Neg	0.035	Neg
126	Silver	0.02	0.000023	0.02	Neg
128	Zinc	0.02	0.000011	0.47	0.000013

TABLE VII-9
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW & EFFLUENT WASTEWATERS CONCENTRATIONS AND LOADS
PAGE 7

FOOTNOTES

(1) No wasteload calculations possible due to contribution from unknown streams.
(2) Untreated wastewater to waste lagoon not included in average.
(3) Includes tandem cold mill waste.

NA : Not analyzed
ND : Not detected
+ : Quantities determined by subtracting other streams yields negative values.
* : Concentration is less than 0.010 mg/l.
Neg: Wasteload is less than 0.000010 lb/1000 lbs.

Treatment Tech. Code

AE : Aeration
AR : Acid regeneration
E : Equalization
FDS: Filtration deep bed sand
FLP: Flocculation with polymer

NL: Neutralization with lime
Cl: Sedimentation via clarifier
SL: Sedimentation via lagoon
VF: Vacuum filtration

TABLE VII-10

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW SPENT CONCENTRATES - CONCENTRATIONS AND LOADS

Raw Wastewater

	Plant Code	I-2		W-2		Z-2		AA-2		091	
	Reference No.	0856P		**		0396D		0384A		0612	
	Sampling Points	-		1		UNK		3		L	
	Flow (gal/ton)	220		11.9		41.4		3.26		18.1	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dissolved Iron	7.1	0.0065	137700	13.7	44300	15.3	116000	3.14	56000	4.24
	Suspended Solids	54	0.049	97	0.0096	120	0.0414	40	0.0011	3026	0.229
	Oil & Grease	NA	NA	5.1	0.00050	1	0.00035	20	0.00055	4.0	0.00030
	pH, Units	4.5-5.0	-	0.6-0.7	-	<1	-	<1	-	<1	-
23	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	*	Neg
114	Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
118	Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	0.28	0.000021
119	Chromium	NA	NA	NA	NA	NA	NA	NA	NA	37	0.0028
120	Copper	NA	NA	NA	NA	NA	NA	NA	NA	22	0.0017
122	Lead	NA	NA	NA	NA	NA	NA	NA	NA	1550	1.17
124	Nickel	NA	NA	NA	NA	NA	NA	NA	NA	22	0.0017
126	Silver	NA	NA	NA	NA	NA	NA	NA	NA	0.30	0.000023
128	Zinc	NA	NA	NA	NA	NA	NA	NA	NA	61	0.0046

TABLE VII-10
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW SPENT CONCENTRATES
PAGE 2

Raw Wastewater

	Plant Code	093		095		099		100		Average	
	Reference No.	0396D		0584F		0528B		0384A			
	Sampling Points	B(1)		B		B		K			
	Flow (gal/ton)	203		49.7		81.7		4.65		70.4	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dissolved Iron	3950	3.35	8000	1.66	75,500	25.8	18000	0.349	56723	7.50
	Suspended Solids	240	0.203	74	0.015	42	0.014	316	0.00613	445	0.0631
	Oil & Grease	237	0.201	4	0.00083	11	0.0038	5	0.000097	35.9	0.0259
+	pH, Units	1.0	-	1.3-3.0	-	<1	-	<1.0	-	<1-5.0	-
23	Chloroform	*	Neg	0.101	0.000021	*	Neg	0.011	Neg	0.028	Neg
114	Antimony	NA	NA	0.187	0.000039	NA	NA	4.2	0.000082	2.19	0.000061
115	Arsenic	0.05	0.000042	0.025	Neg	0.40	0.00014	NA	NA	0.158	0.000061
118	Cadmium	0.02	0.000017	ND	ND	0.31	0.00011	0.28	Neg	0.178	0.000030
119	Chromium	0.84	0.00071	1.50	0.000031	18	0.0061	8.7	0.00017	13.2	0.00202
120	Copper	0.67	0.00057	2.42	0.00050	28	0.0096	11	0.00021	12.8	0.0025
122	Lead	0.43	0.00036	ND	ND	*	Neg	2.1	0.000041	310.5	0.234
124	Nickel	0.48	0.00041	2.50	0.00052	13	0.0044	13	0.00025	10.2	0.0015
126	Silver	0.03	0.000025	ND	ND	0.31	0.00011	0.39	Neg	0.21	0.000032
128	Zinc	1.5	0.0013	2.50	0.00052	4.2	0.0014	4.6	0.000089	14.8	0.00158

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(1): Combined rinses & concentrates
ND : Not detected
NA : Not analyzed
Neg: Wasteload is less than 0.000010 lbs/1000lbs
* : Concentration is less than 0.010 mg/l
+ : Cannot be evaluated
** : Plant reference code not assigned.

TABLE VII-11

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW FUME HOOD SCRUBBER WASTEWATERS - CONCENTRATIONS AND LOADS

Raw Wastewater

	Plant Code	**		**		0396D		0584F		0528B	
	Reference Code	W-2		Y-2		093		095		099	
	Sampling Points	6		4		J		GA		F	
	Flow (gal/ton)	45.5		39.7		31.1		0.386		6.1	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dissolved Iron	23.9	0.0045	3.8	0.00063	880	3.55	733	0.00118	45	0.00115
	Suspended Solids	3.0	0.00055	6.7	0.00111	2132	8.61	21	0.000034	22	0.00056
	Oil & Grease	5.3	0.0010	2	0.00033	330	1.33	46	0.000074	14	0.00036
	pH, Units	2.8-3.7	-	1.8-1.9	-	1.6	-	1.2	-	<1	-
23	Chloroform	NA	NA	NA	NA	*	0.000040	0.369	Neg	*	Neg
114	Antimony	NA	NA	NA	NA	NA	NA	0.117	Neg	NA	NA
115	Arsenic	NA	NA	NA	NA	*	0.000040	0.047	Neg	0.08	Neg
118	Cadmium	NA	NA	NA	NA	*	0.000040	0.20	Neg	*	Neg
119	Chromium	NA	NA	NA	NA	0.29	0.00117	0.35	Neg	0.09	Neg
120	Copper	NA	NA	NA	NA	0.76	0.0031	0.503	Neg	0.10	Neg
122	Lead	NA	NA	NA	NA	0.35	0.0014	0.60	Neg	0.10	Neg
124	Nickel	NA	NA	NA	NA	0.20	0.00081	0.50	Neg	0.08	Neg
126	Silver	NA	NA	NA	NA	*	0.000040	0.25	Neg	0.02	Neg
128	Zinc	NA	NA	NA	NA	1.7	0.0069	0.35	Neg	0.11	Neg

TABLE VII-11
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW FUME HOOD SCRUBBER WASTEWATERS - CONCENTRATIONS AND LOADS
PAGE 2

Raw Wastewater

	Plant Code	0384A			
	Reference Code	100			
	Sampling Points	J		Average	
	Flow (gal/ton):	3.37		21.0	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dissolved Iron	3210	0.0452	816	0.600
	Suspended Solids	29	0.00041	369	1.44
	Oil & Grease	3	0.000042	66	0.222
	pH, Units	1.0-1.2	-	<1-3.7	-
23	Chloroform	*	Neg	0.100	0.000010
114	Antimony	0.6	Neg	0.359	Neg
115	Arsenic	NA	NA	0.046	0.000[illegible]
118	Cadmium	0.015	Neg	0.059	0.00010
119	Chromium	0.72	0.000010	0.36	0.00030
120	Copper	1.7	0.000024	0.77	0.00078
122	Lead	0.08	Neg	0.28	0.00035
124	Nickel	1.4	0.000020	0.55	0.00021
126	Silver	0.20	Neg	0.12	0.000010
128	Zinc	0.45	Neg	0.65	0.0017

+ : Value determined by subtracting other contributing streams yielded a negative value.
NA : Not analyzed.
* : Concentration is less than 0.010 mg/l.
Neg: Wasteload is less than 0.000010 lbs/1000lbs.
** : Plant has no assigned reference number.

TABLE VII-12

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW ABSORBER VENT SCRUBBER WASTEWATERS - CONCENTRATIONS AND LOADS

	Raw Wastewater										
	Plant Code	W-2		X-2		Y-2(1)		Y-2(2)		095	
	Reference No.	**		0060B		**		**		0584F	
	Sampling Points	2		2		1		2		C	
	Flow (gal/ton)	98.6		220		288		336		69	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dissolved Iron	15	0.0062	63.5	0.072	+	+	0.41	0.00058	3670	1.06
	Suspended Solids	129	0.053	70	0.079	85	0.102	1.5	0.0021	194	0.0559
	Oil & Grease	2.2	0.0009	+	+	+	+	+	+	3	0.00086
	pH, Units	3.7-7.6	-	6.9-7.1	-	7.0-7.1	-	1.7	-	1.7-2.1	-
23	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	0.026	Neg
114	Antimony	NA	NA	NA	NA	NA	NA	NA	NA	0.22	0.000063
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	0.025	Neg
118	Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	0.02	Neg
119	Chromium	NA	NA	NA	NA	NA	NA	NA	NA	0.58	0.000167
120	Copper	NA	NA	NA	NA	NA	NA	NA	NA	1.503	0.000423
122	Lead	NA	NA	NA	NA	NA	NA	NA	NA	0.60	0.00017
124	Nickel	NA	NA	NA	NA	NA	NA	NA	NA	0.790	0.00023
126	Silver	NA	NA	NA	NA	NA	NA	NA	NA	0.25	0.000072
128	Zinc	NA	NA	NA	NA	NA	NA	NA	NA	1.277	0.000368

TABLE VII-12
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
HYDROCHLORIC ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW ABSORBER VENT SCRUBBER WASTEWATERS
PAGE 2

Raw Wastewater

	Plant Code	099			
	Reference No.	0582B			
	Sampling Points	F+E		Average	
	Flow (gal/ton)	176		205	
		mg/l	lbs/1000lbs	mg/l	lbs/1000lbs
	Dissolved Iron	150	0.11	650	0.207
	Suspended Solids	67	0.0492	91	0.0566
	Oil & Grease	7	0.0051	2	0.0011
	pH, Units	<1.0-2.3	-	<1.0-7.6	-
23	Chloroform	*	Neg	0.018	Neg
114	Antimony	NA	NA	0.22	0.000063
115	Arsenic	*	Neg	0.018	Neg
118	Cadmium	*	Neg	0.015	Neg
119	Chromium	0.98	0.00072	0.78	0.00043
120	Copper	0.436	0.00032	0.97	0.00037
122	Lead	0.10	0.000073	0.35	0.00012
124	Nickel	0.64	0.00047	0.72	0.00034
126	Silver	*	Neg	0.13	0.000036
128	Zinc	0.73	0.00054	1.00	0.00044

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(1): Acid regeneration unit with cyclone.
(2): Acid regeneration unit with electrostatic precipator.
Neg: Wasteload is less than 0.000010 lbs/1000 lbs.
NA : Not analyzed.
* : Concentration is less than 0.010 mg/l.
+ : Value obtained by substracting other contributing streams yielded a negative value.
** : Plant has no assigned reference number

TABLE VII-13

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
COMBINATION ACID PICKLING - BATCH PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS

Raw Wastewater

	Reference No.	0748		0424		0856H		0440A	
	Plant Code	U		C		F		L	
	Sample Point	1		2		1		10	
	Flow (gal/ton)	677		91		279		140	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	4	0.0113	106	0.0402	8	0.0093	179	0.105
	Oil and Grease	3	0.0085	5	0.0019	0.7	0.0008	1.9	0.0011
	Fluoride	500	1.41	1,725	0.655	174	0.203	1.4	0.00082
	Dissolved Iron	1,080	3.05	216	0.082	61	0.07	135	0.0788
	pH, Units	1.9	-	0.4-0.8	-	2.6-2.9	-	2.8-3.8	-
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA
119	Chromium	152	0.429	137	0.052	13.4	0.0156	24.4	0.0142
120	Copper	1.38	0.0038	9.5	0.0036	0.06	0.000070	0.8	0.0005
122	Lead	*	Neg	NA	NA	*	Neg	*	Neg
124	Nickel	70	0.198	241	0.0915	9.4	0.0109	12.5	0.0073
128	Zinc	5.6	0.0158	0.87	0.003	0.07	0.000081	0.08	0.000047

Effluent

	Plant Code	U		C		F(1)		L	
	Reference No.	-		0424		0856H		0440A	
	Sample Points	4		4		4		1	
	Streams Treated	Rinses & Concentrates		Rinses		Rinses & Fume Hood Scrub.		Rinses	
	Treatment Tech.	NL, SL		E, NL, PSP		E, NL, SL		NW	
	Flow (gal/ton)	677		91		279		140	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	12	0.0339	31	0.0118	430	0.50	119	0.0695
	Oil and Grease	1.0	0.0028	0.3	0.0001	1.6	0.0019	3.0	0.00175
	Fluoride	12	0.0339	133	0.0505	68.7	0.0799	1.4	0.000817
	Dissolved Iron	0.02	0.000057	8.5	0.0032	41.1	0.0478	0.1	0.000058
	pH, Units	10.4	-	5.0	-	5.8	-	5.8	-
115	Arsenic	NA	NA	NA	NA	NA	NA	NA	NA
119	Chromium	0.04	0.0001	1.3	0.0005	7.3	0.0085	0.61	0.000356
120	Copper	0.03	0.000085	0.08	0.000030	0.07	0.000081	0.01	0.0000058
122	Lead	NA	NA	NA	NA	NA	NA	NA	NA
124	Nickel	0.02	0.000057	2.5	0.0095	6.7	0.0078	0.16	0.000356
128	Zinc	0.03	0.000085	0.035	0.000013	0.14	0.0016	0.01	Neg

TABLE VII-13
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
COMBINATION ACID PICKLING - BATCH PROCESS
GROSS WASTEWATER - CONCENTRATIONS AND LOADS
PAGE 2

Raw Wastewater

	Reference No.	0088A		0088D		0884E			
	Plant Code	123		124		125			
	Sample Point	D		B		C		Average	
	Flow (gal/ton)	310		1176		650		475	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	36	0.0459	2	0.0098	3	0.0081	48.3	0.0319
	Oil and Grease	5	0.00646	11	0.054	6	0.0163	4.6	0.0124
	Fluoride	NA	NA	25	0.12	52	0.141	428	0.439
	Dissolved Iron	46	0.0595	10	0.049	5	0.0136	222	0.486
	pH, Units	2.6-2.7	-	2.7	-	3.5-3.6	-	1.9-3.6	-
115	Arsenic	0.01	0.000013	0.01	0.000049	0.01	0.000027		
119	Chromium	3.21	0.0042	6.2	0.0304	1.1	0.00298	48.1	0.078
120	Copper	0.26	0.000336	0.02	0.000098	0.08	0.000230	1.28	0.0011
122	Lead	0.10	0.000129	0.05	0.000245	0.05	0.000135	0.067	0.00017
124	Nickel	7.6	0.0099	27	0.132	0.56	0.00153	52.5	0.064
128	Zinc	0.08	0.000110	0.05	0.000245	0.02	0.000054	0.97	0.0024

Effluent

	Plant Code	123		124		125	
	Reference No.	0088A		0088D		0884E	
	Sample Points	(D/F+G+H)xI		C		(C/C+F+D)xE	
	Streams Treated	Rinses & Concentrates		Rinses		Rinses, Fume Hood Scrubbers & Concen.	
	Treatment Tech.	E, NL, FLP, CL		E, NC, FDSP		E, NL, FLP, PSP	
	Flow (gal/ton)	310		1176		650	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Suspended Solids	28.5	0.00646	65	0.314	527	0.694
	Oil and Grease	8.50	0.00	5	0.0245	24	0.0434
	Fluoride	NA	NA	10	0.0490	94.5	0.260
	Dissolved Iron	0.445	0.00129	ND	ND	0.04	0.00
	pH, Units	7.9	-	11.9	-	11.9	-
115	Arsenic	*	0.00	*	0.000049	*	0.000027
119	Chromium	0.355	Neg	1.9	0.00932	10.6	0.0352
120	Copper	0.030	0.000026	0.03	0.000147	0.185	0.000542
122	Lead	0.100	*	0.050	0.000245	0.125	+
124	Nickel	0.325	0.000776	8	0.0392	6.79	0.0217
128	Zinc	0.115	Neg	0.495	0.00243	0.140	+

TABLE VII-13
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
COMBINATION ACID PICKLING - BATCH PROCESS
RINSE WASTEWATER - CONCENTRATIONS AND LOADS
PAGE 3

FOOTNOTES

(1) Sample taken prior to final settling.
NA : Not analyzed.
ND : Not detected.
Neg: Wasteload is less than 0.000010 lbs/1000 lbs
+ : Unable to calculate.
* : Concentration is less than 0.010 mg/l.

Treatment Tech. Code

E : Equalization
FDSP: Deep bed sand pressure filtration
FLP : Flocculation with polymer
NC : Neutralization with caustic

NL : Neutralization with lime
NW : Neutralization with wastes
PSP : Primary scale pit
SC : Sedimentation via clarifier
SL : Sedimentation via lagoon

TABLE VII-14

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
COMBINATION ACID PICKLING - CONTINUOUS PROCESS
GROSS RAW AND EFFLUENT WASTEWATERS - CONCENTRATIONS AND LOADS

Raw Wasteload

	Plant Code	D		I		O	
	Reference No.	0248B		0432K		0176	
	Sample Points	4		4		29	
	Flow (gal/ton)	1016		1814		974	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	400.4	1.70	61.5	0.465	1.8	0.00731
	Suspended Solids	67	0.284	562	4.25	80	0.325
	Oil and Grease	16.3	0.0691	0.7	0.0053	9.9	0.0749
	Fluoride	47.5	0.201	33.3	0.252	16.0	0.065
	pH, Units	3.0	-	6.5	-	8.0	-
4	Benzene	NA	NA	NA	NA	NA	NA
119	Chromium	48.4	0.205	17.1	0.465	0.5	0.00203
120	Copper	NA	NA	0.15	0.00113	0.06	0.000244
124	Nickel	31.4	0.133	6.0	0.0454	2.1	0.00853
128	Zinc	NA	NA	0.75	0.00567	0.1	0.000406

Effluents

	Plant Code	D		I		O	
	Reference No.	0248B		0432K		0176	
	Sample Points	4		5		19	
	Systems Treated	Rinses		Rinses and Concentrates		Rinses	
	Treatment Technology	None		NL, SL		E, NL, FLP, CL, T	
	Flow (gal/ton)	1016		1814		941	
	Parameters	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	400.4	1.7	24.2	0.183	0.2	0.000785
	Suspended Solids	67	0.284	132	0.998	21	0.0824
	Oil and Grease	16.3	0.0691	1.5	0.0113	0.5	0.00196
	Fluoride	47.5	0.201	9.1	0.0688	18.9	0.0741
	pH	3.0	-	6.2	-	8.0	-
4	Benzene	NA	NA	NA	NA	NA	NA
119	Chromium	48.4	0.205	1.8	0.0136	2.7	0.0106
120	Copper	NA	NA	ND	ND	0.11	0.000432
124	Nickel	31.4	0.133	5.2	0.0393	1.2	0.00471
128	Zinc	NA	NA	0.24	0.00182	0.05	0.000196

TABLE VII-14
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
COMBINATION ACID PICKLING - CONTINUOUS PROCESS
RINSE WASTEWATER - CONCENTRATIONS AND LOADS
PAGE 2

Raw Wastewater

Plant Code		121			
Reference No.		0900			
Sample Points		B		Average	
Flow (gal/ton)		2754			
Parameters		mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
	Dissolved Iron	148	1.70	152.9	0.968
	Suspended Solids	14.3	0.164	180.8	1.26
	Oil and Grease	6.3	0.0724	8.3	0.055
	Fluoride	180	2.07	69.2	0.647
	pH, Units	2.4-2.7	-	2.4-8.0	-
4	Benzene	0.049	0.00567	0.049	0.000567
119	Chromium	33.4	0.383	24.9	0.264
120	Copper	0.59	0.00678	0.27	0.0027
124	Nickel	20	0.230	14.9	0.104
128	Zinc	0.33	0.0038	0.39	0.0033

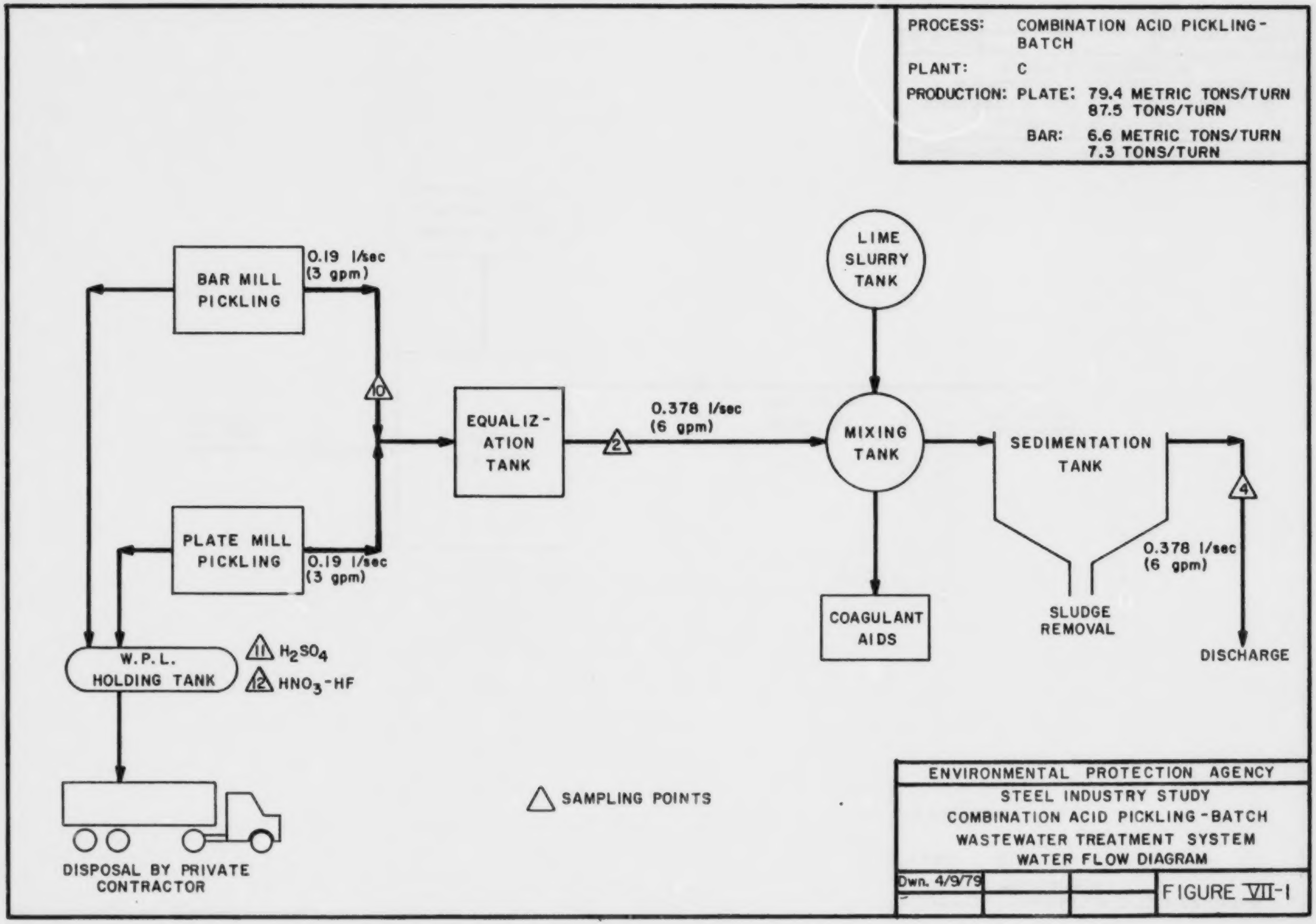
Effluents

Plant Code		121	
Reference No.		0900	
Sample Points		4	
Systems Treated		Rinses, FHS and Concentrates	
Treatment Technology		E,CL,CR	
Flow (gal/ton)		1338	
Parameters		mg/l	lbs/1000 lbs
	Dissolved Iron	0.26	0.00145
	Suspended Solids	8	0.0446
	Oil and Grease	4.3	0.0247
	Fluoride	9.5	0.0544
	pH, Units	7.9	NA
4	Benzene	0.033	0.000186
119	Copper	0.074	0.000413
120	Chromium	0.90	0.00503
124	Nickel	0.37	0.00205
128	Zinc	0.07	0.000391

NA: Not analyzed.
ND: Not detected.

Treatment Tech. Code

CR : Chemical reduction
E : Equalization
FLP: Flocculation with polymer
NL : Neutalization with lime
CL : Sedimentation via clarifier
SL : Sedimentation via lagoons
T : Sedimentation via thickener



PROCESS: COMBINATION ACID PICKLING-BATCH
PLANT: C
PRODUCTION: PLATE: 79.4 METRIC TONS/TURN
87.5 TONS/TURN
BAR: 6.6 METRIC TONS/TURN
7.3 TONS/TURN

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING-BATCH
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

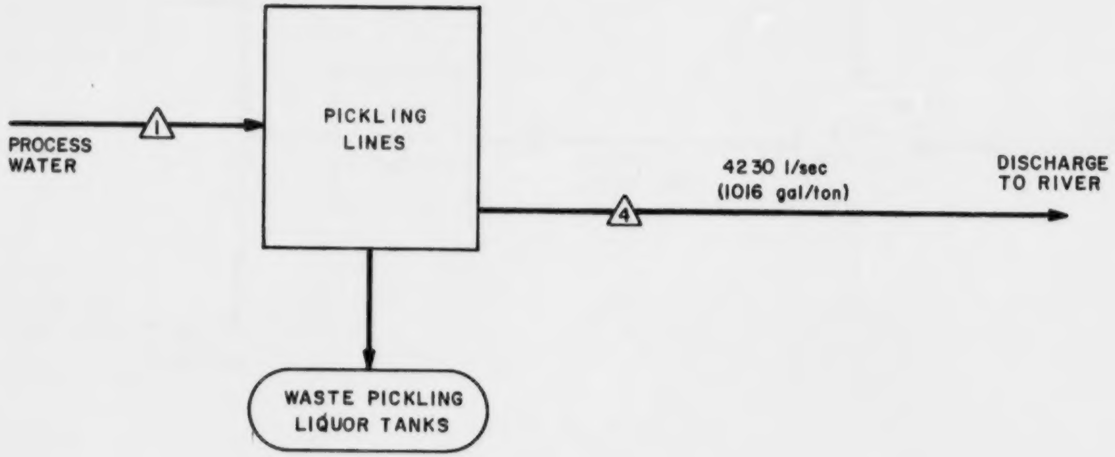
Dwn. 4/9/79

FIGURE VII-1

PROCESS: COMBINATION ACID PICKLING-CONTINUOUS

PLANT: D

PRODUCTION:

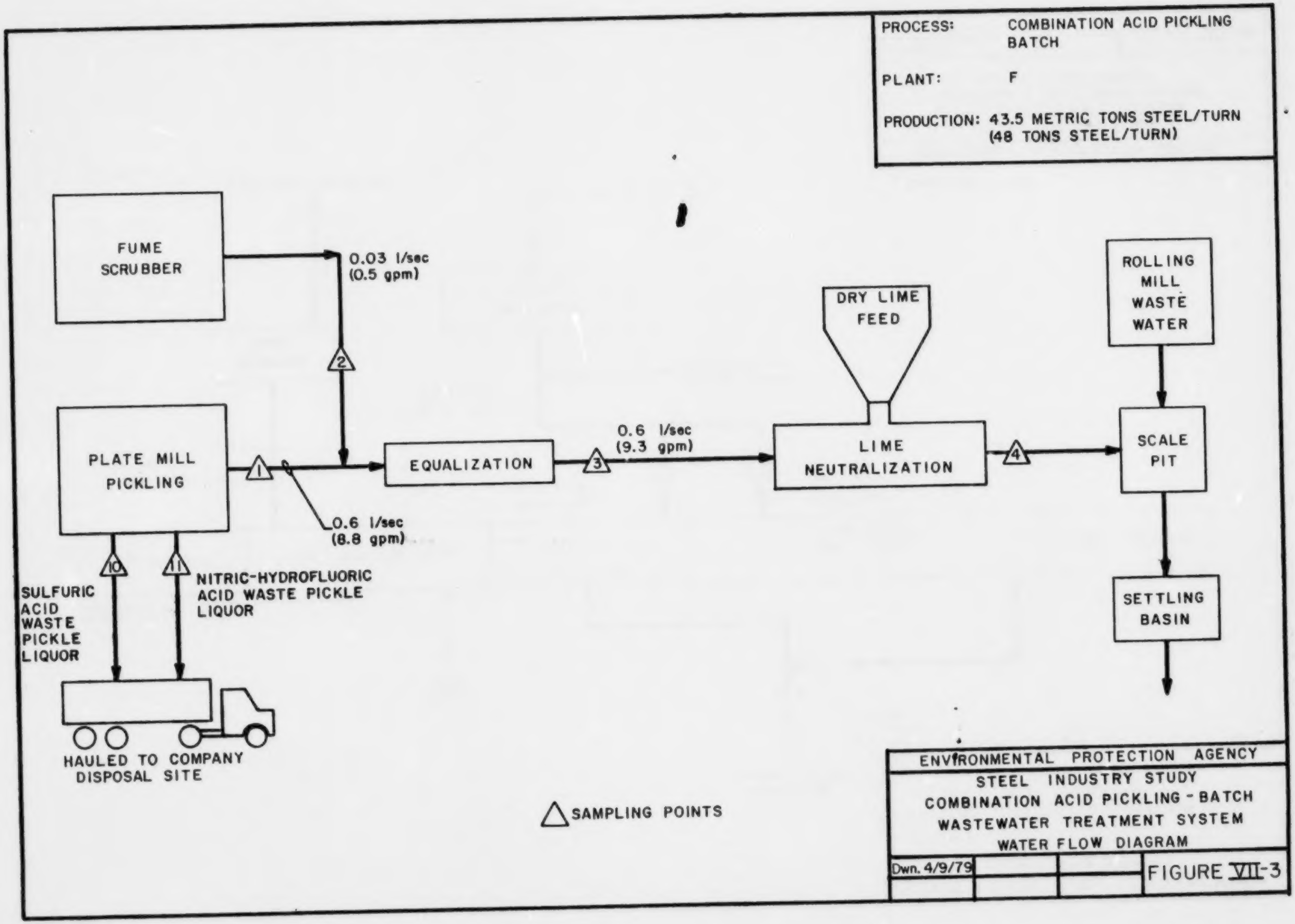


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING-CONTINUOUS
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 4/9/79

FIGURE VII-2



PROCESS: COMBINATION ACID PICKLING BATCH

PLANT: F

PRODUCTION: 43.5 METRIC TONS STEEL/TURN (48 TONS STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY

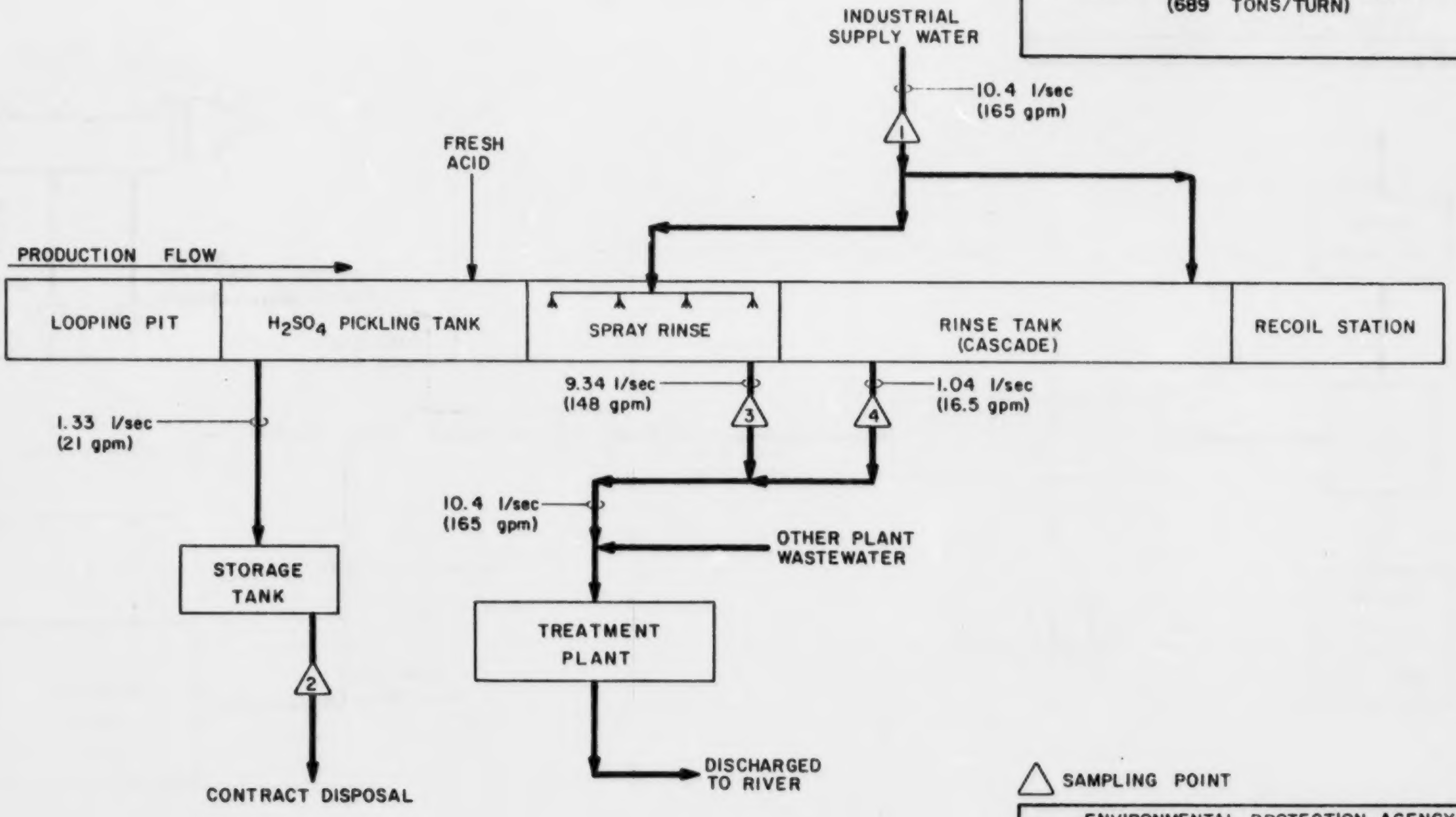
COMBINATION ACID PICKLING - BATCH

WASTEWATER TREATMENT SYSTEM

WATER FLOW DIAGRAM

FIGURE VII-3

PROCESS: PICKLING - H_2SO_4 - CONTINUOUS STRIP
CONCENTRATES & RINSES
PLANT: H-2
PRODUCTION: 625 METRIC TONS/TURN
(689 TONS/TURN)

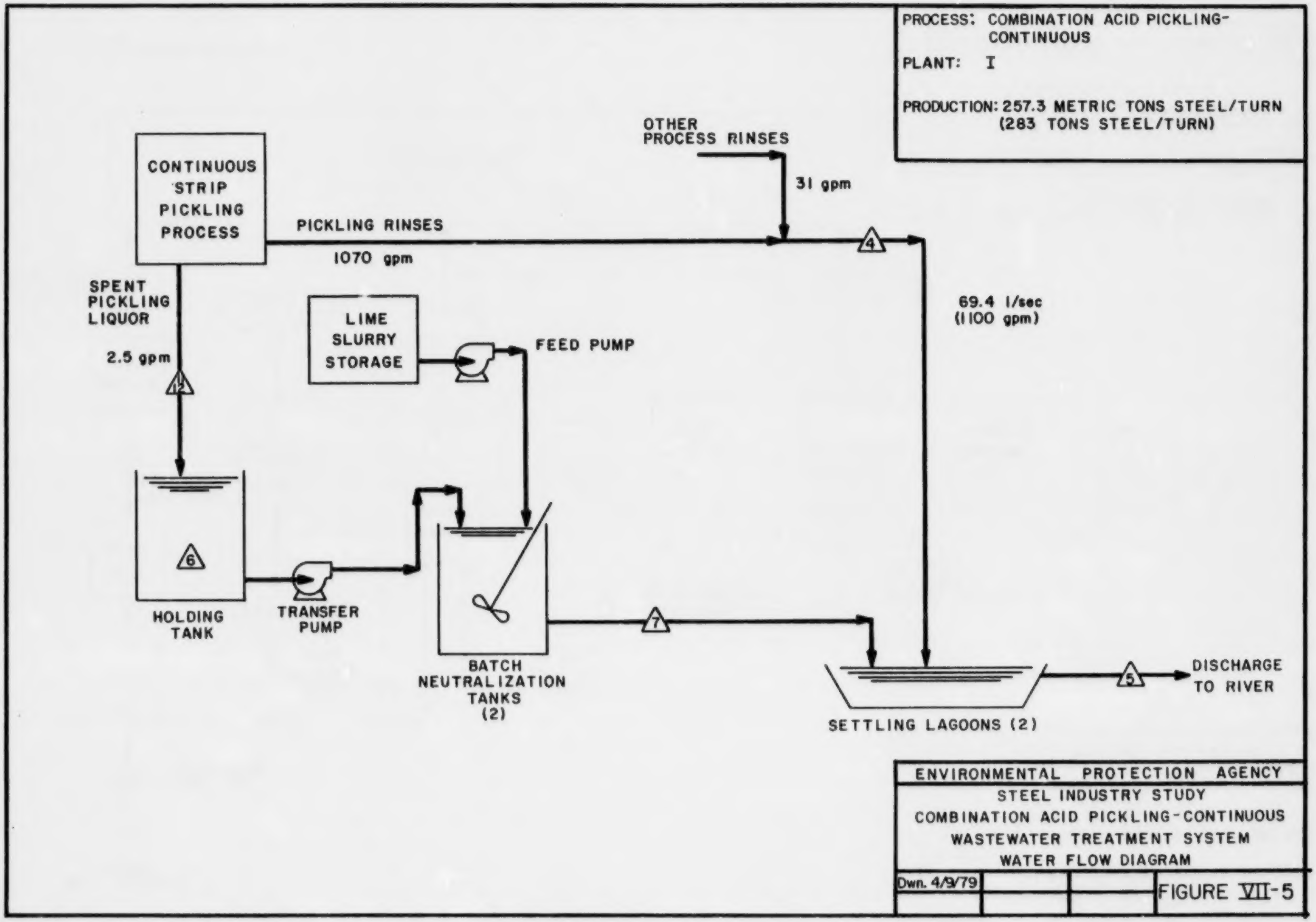


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
CONTINUOUS SULFURIC PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/30/79

FIGURE VII-4



PROCESS: COMBINATION ACID PICKLING-CONTINUOUS

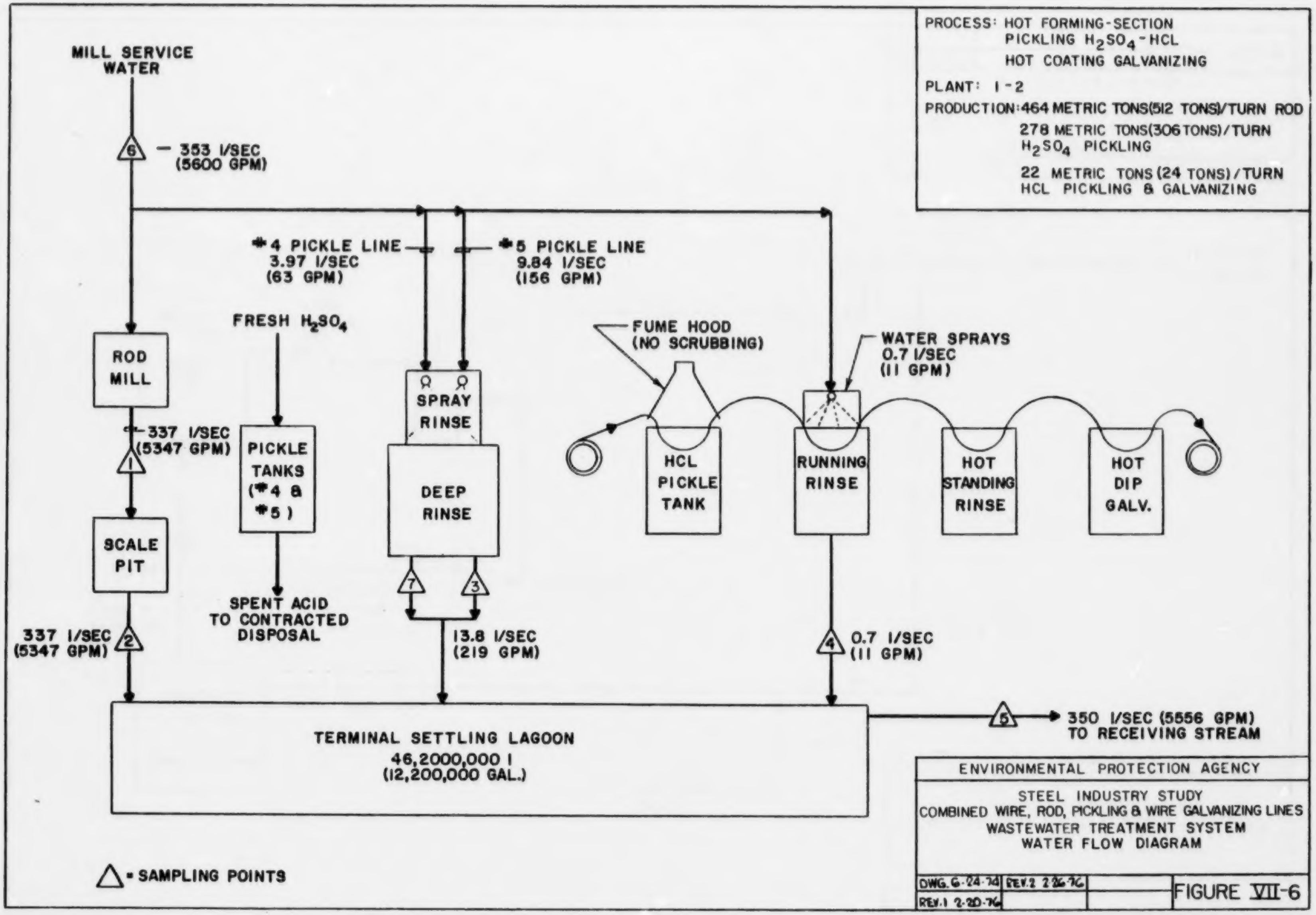
PLANT: I

PRODUCTION: 257.3 METRIC TONS STEEL/TURN (283 TONS STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING-CONTINUOUS
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 4/9/79

FIGURE VII-5



ENVIRONMENTAL PROTECTION AGENCY

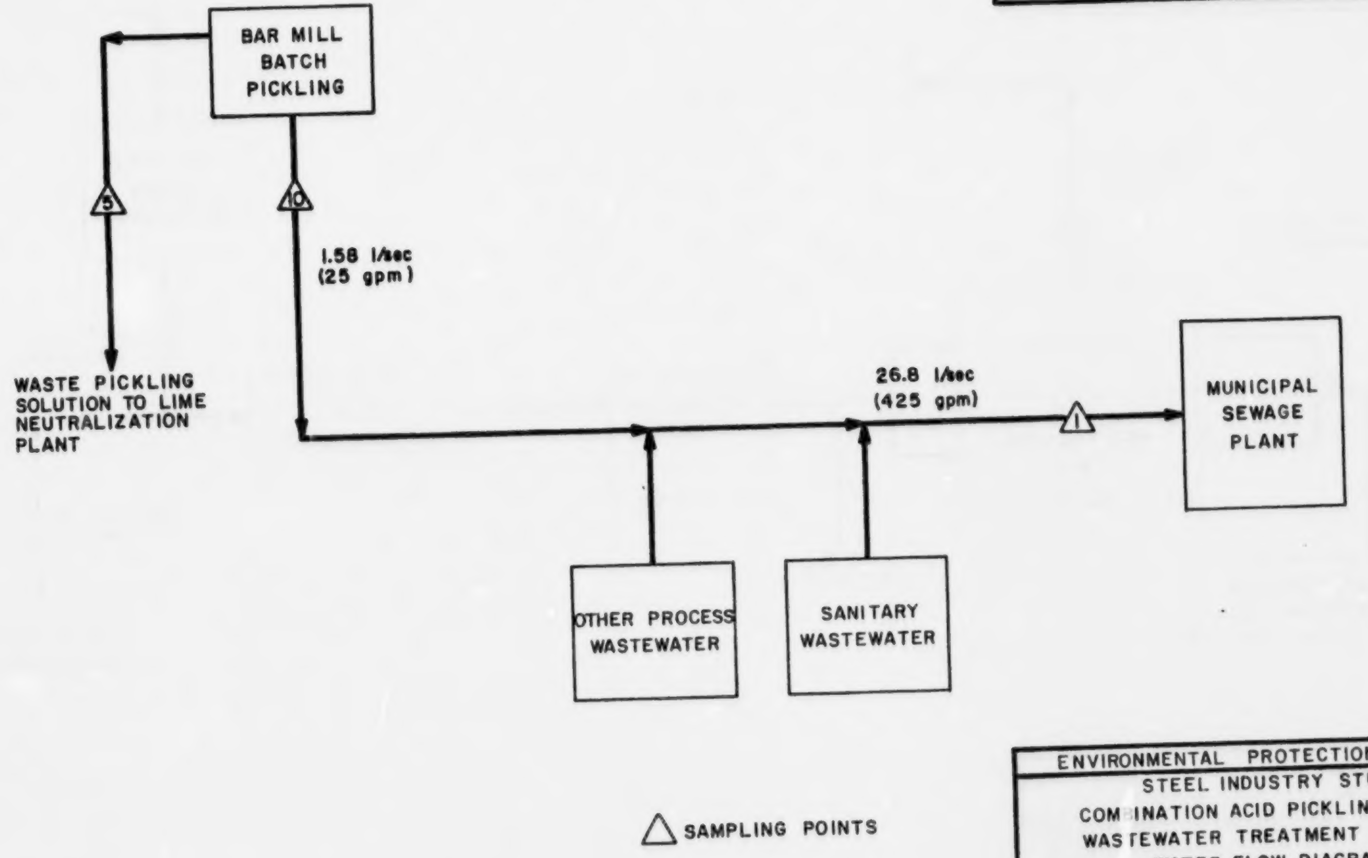
STEEL INDUSTRY STUDY
COMBINED WIRE, ROD, PICKLING & WIRE GALVANIZING LINES
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-6

PROCESS: COMBINATION ACID PICKLING-BATCH

PLANT: L

PRODUCTION: 39.1 METRIC TONS STEEL/TURN
(43.1 TONS STEEL/TURN)



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING - BATCH
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

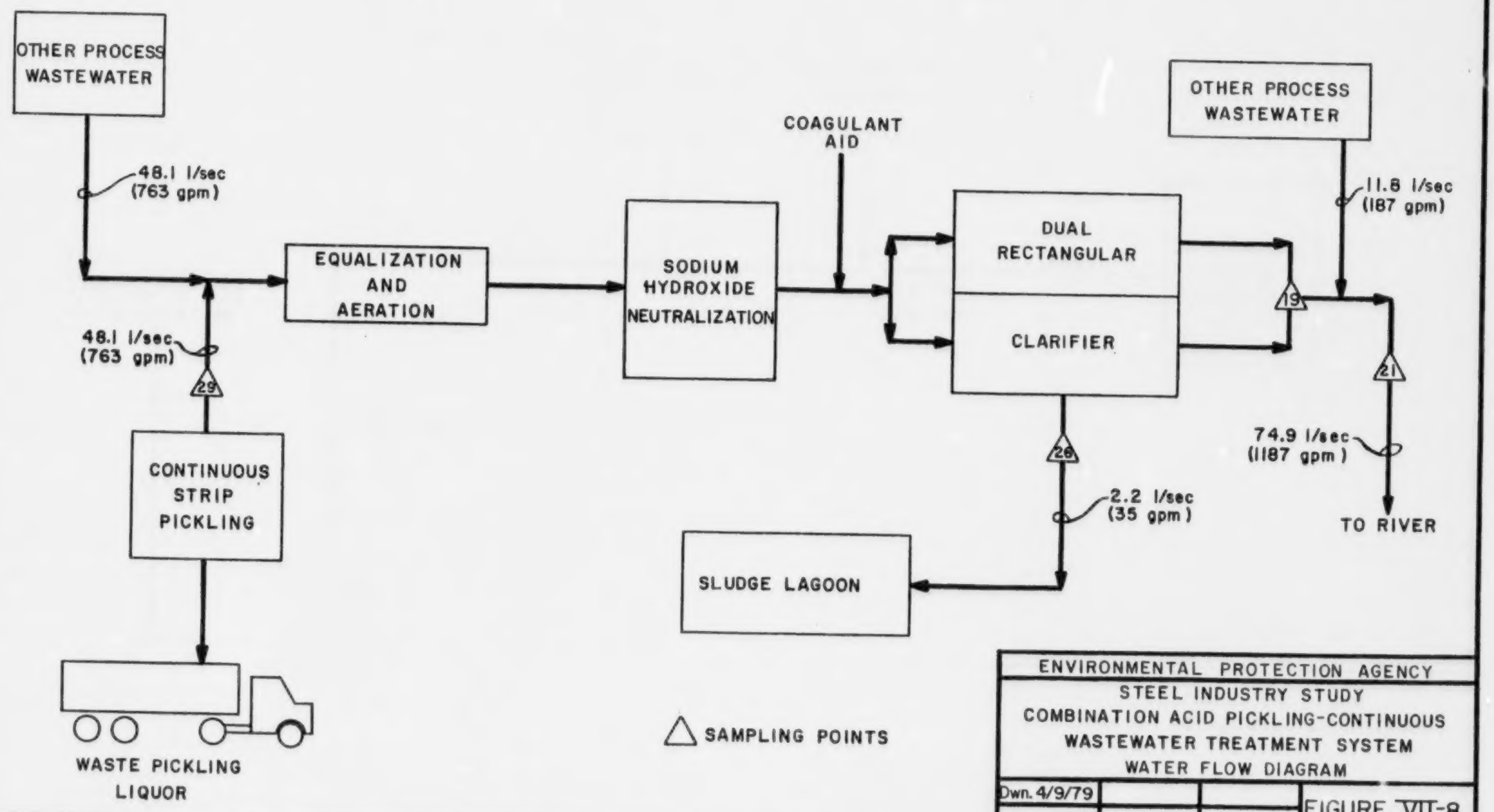
Dwn. 4/9/79

FIGURE VII-7

PROCESS: COMBINATION ACID PICKLING-CONTINUOUS

PLANT: O

PRODUCTION: 40.5 METRIC TONS STEEL/TURN (44.6 TONS STEEL/TURN)



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING-CONTINUOUS
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

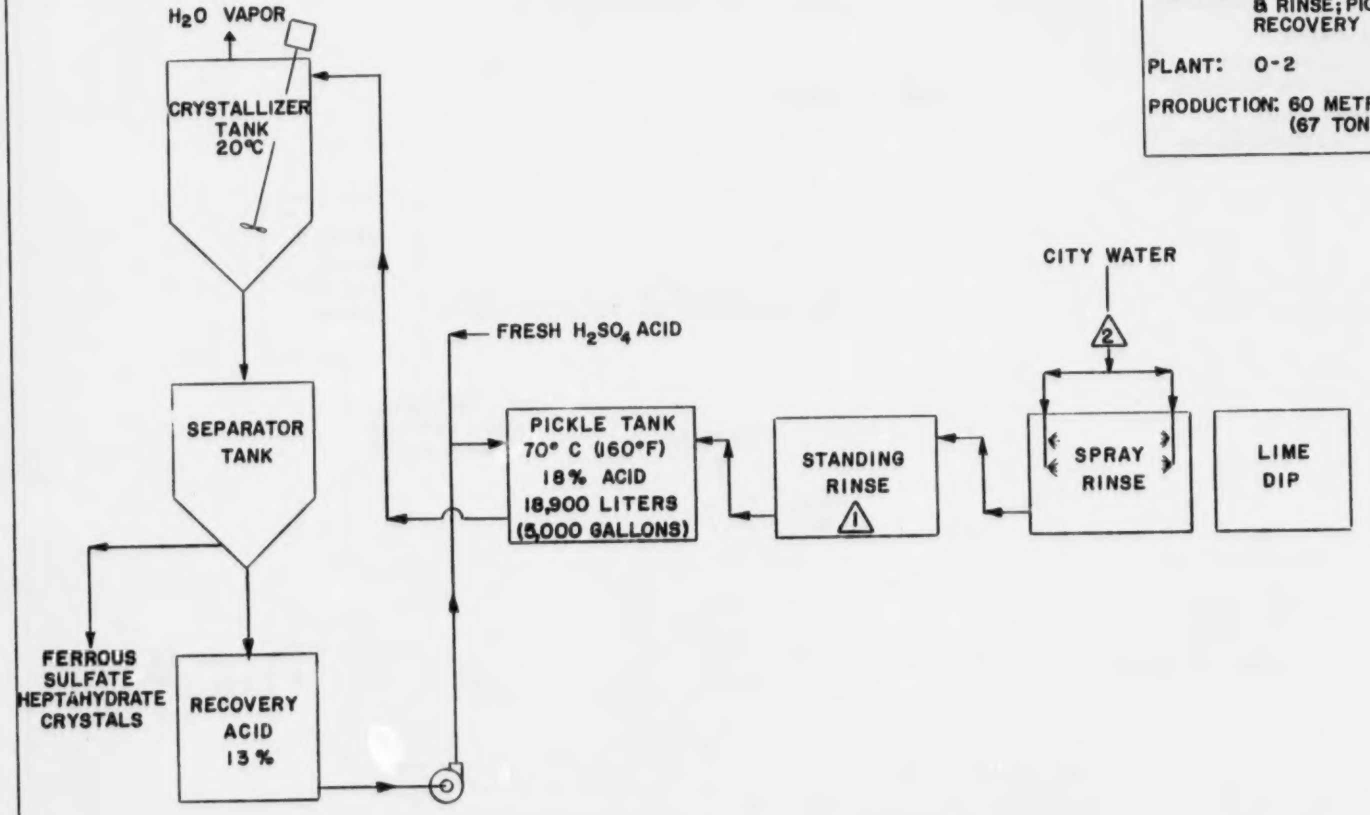
Dwn. 4/9/79

FIGURE VII-8

PROCESS: PICKLING H_2SO_4-BATCH-CONCENTRATED & RINSE; PICKLING-SULFURIC ACID RECOVERY

PLANT: O-2

PRODUCTION: 60 METRIC TONS STEEL/TURN (67 TONS STEEL/TURN)



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING AND ACID RECOVERY OPERATION
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

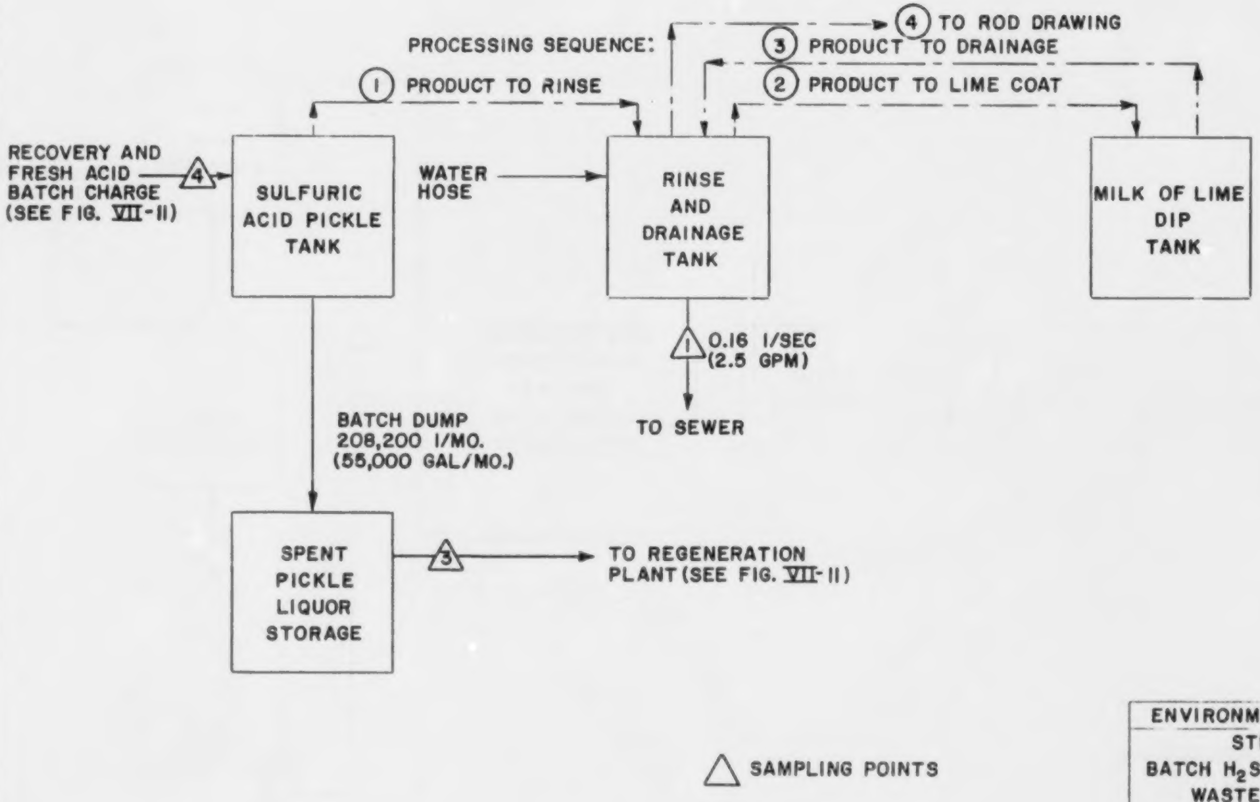
Dwn.6/6/75 Rev.2/26/76
Rev.6/20/76

FIGURE VII-9

PROCESS: PICKLING H_2SO_4-BATCH-CONCENTRATED & RINSE, PICKLING SULFURIC ACID RECOVERY

PLANT: P-2

PRODUCTION: 43 METRIC TONS OF STEEL/TURN (47 TONS OF STEEL/TURN)



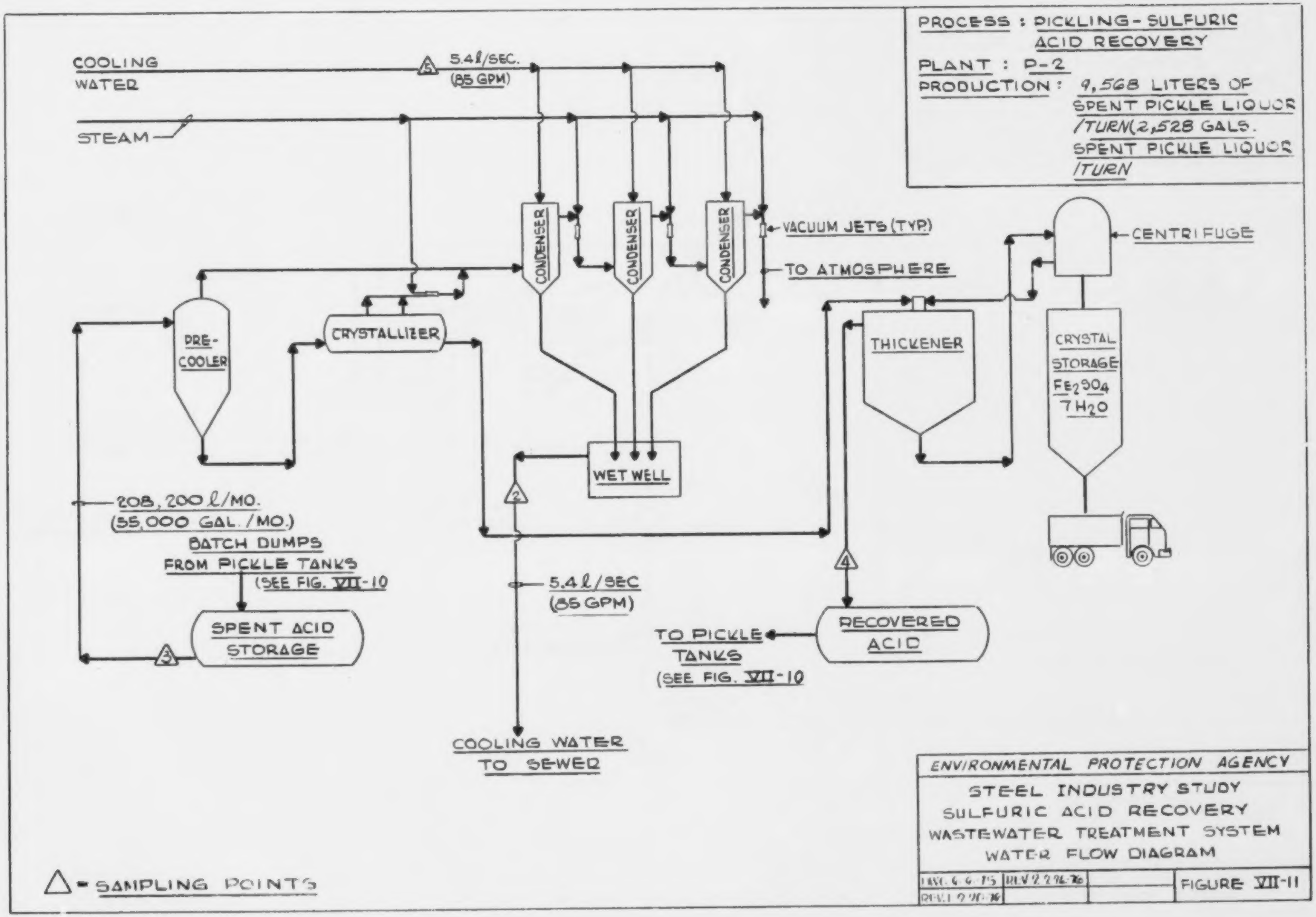
ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY

BATCH H_2SO_4 PICKLING AND ACID RECOVERY WASTEWATER TREATMENT SYSTEM WATER FLOW DIAGRAM

Dwn. 7/16/80

FIGURE VII-10

</br>

PROCESS : PICKLING - SULFURIC ACID RECOVERY

PLANT : P-2

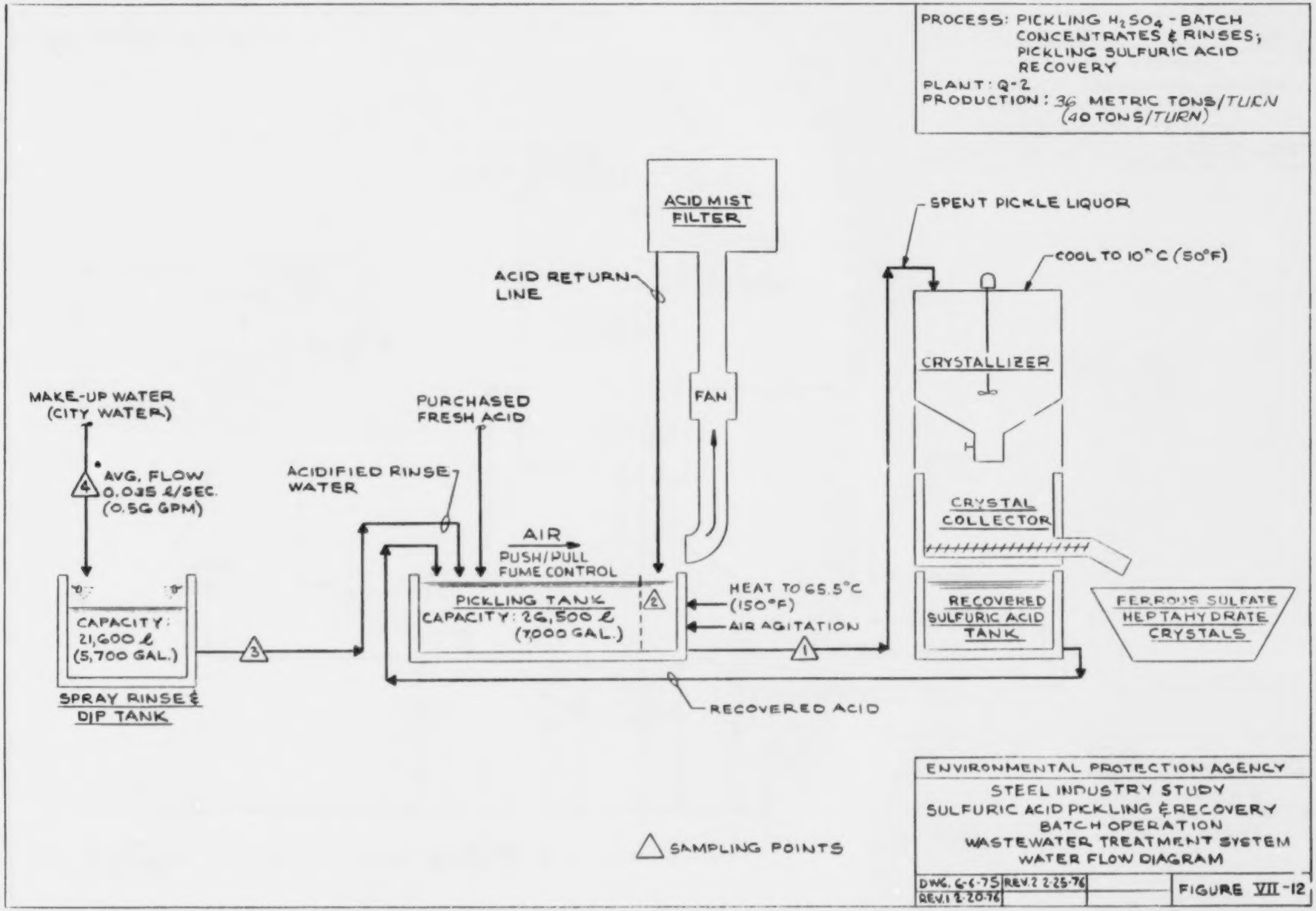
PRODUCTION : 9,568 LITERS OF SPENT PICKLE LIQUOR /TURN (2,528 GALS. SPENT PICKLE LIQUOR /TURN

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SULFURIC ACID RECOVERY
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG. 6-6-75 REV 2 2-26-76
REV 1 2-20-76

FIGURE VII-11



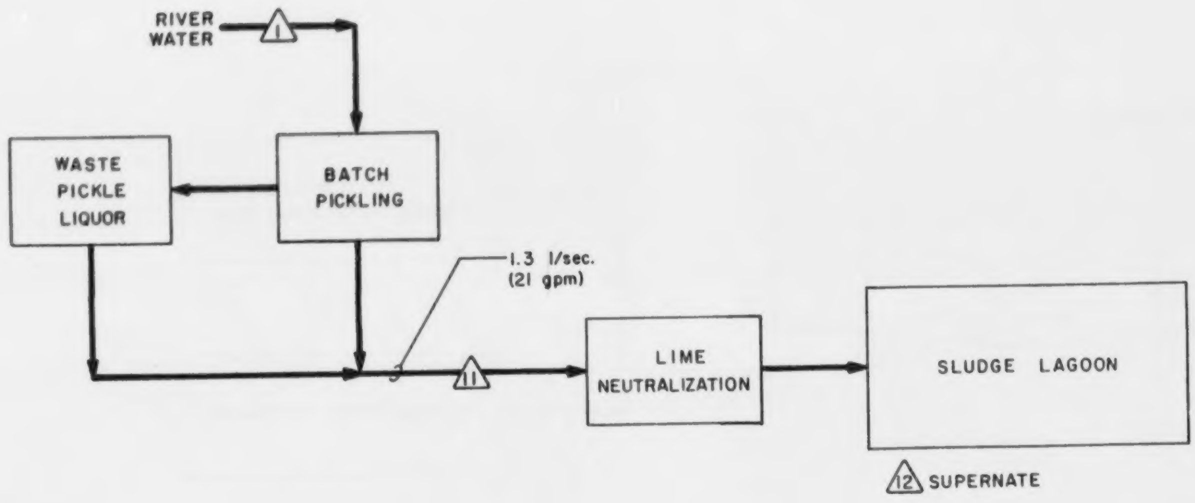
PROCESS: PICKLING H_2SO_4 - BATCH CONCENTRATES & RINSES; PICKLING SULFURIC ACID RECOVERY
PLANT: Q-2
PRODUCTION: 36 METRIC TONS/TURN
(40 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING & RECOVERY
BATCH OPERATION
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG. 6-6-75 REV. 2 2-25-76
REV. 1 2-20-76

FIGURE VII-12

PROCESS: BATCH PICKLING (SULFURIC ACID)
PLANT: R
PRODUCTION: 301 METRIC TONS STEEL/TURN
(332 TONS STEEL/TURN)



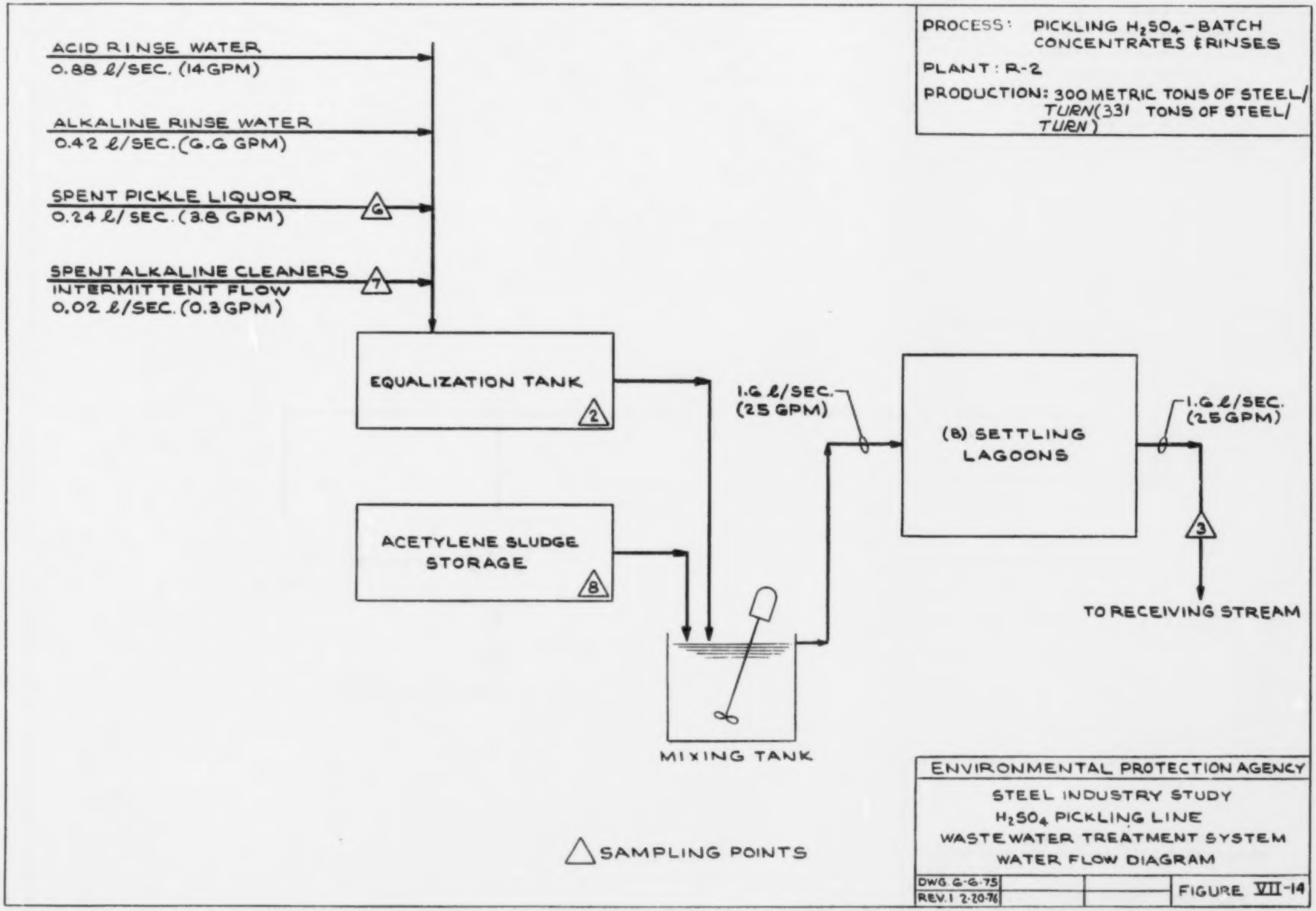
△ SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SULFURIC ACID BATCH PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/28/79

FIGURE VII-13



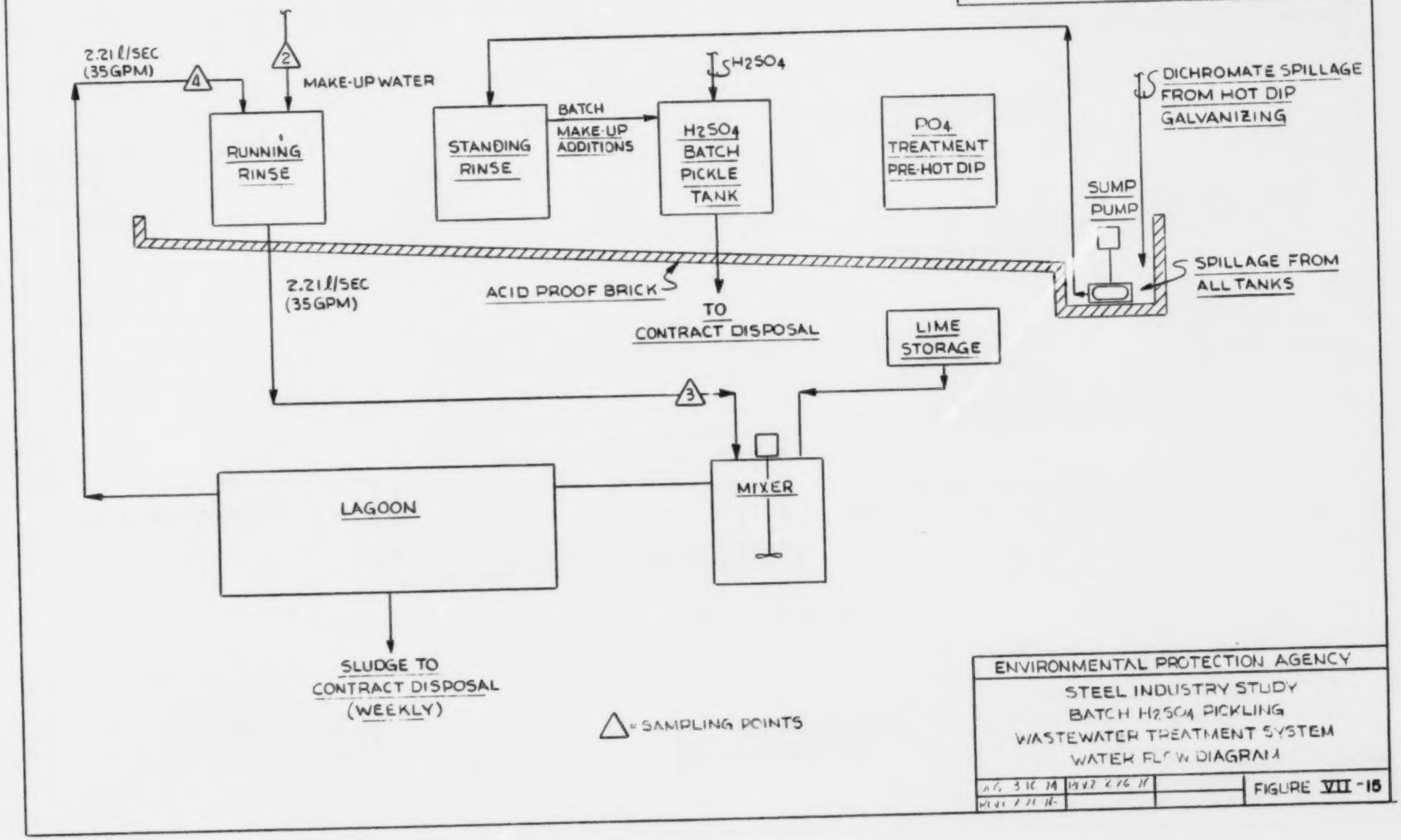
ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
H_2SO_4 PICKLING LINE
WASTE WATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-14

PROCESS: PICKLING - H_2SO_4 - BATCH RINSE
PLANT: S-2

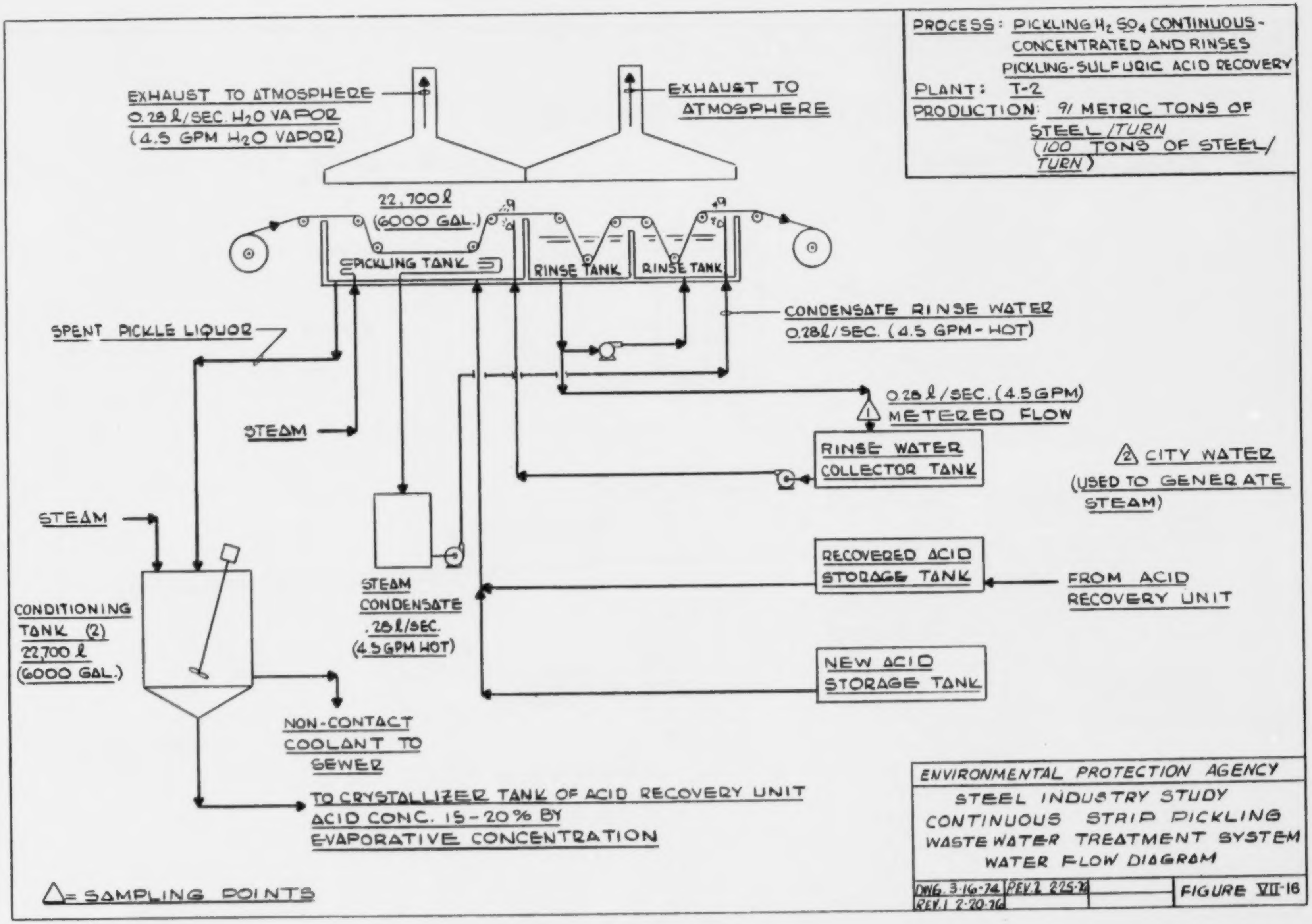
PRODUCTION: 77 METRIC TONS OF STEEL/TURN
(85 TONS OF STEEL/TURN)



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
BATCH H_2SO_4 PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

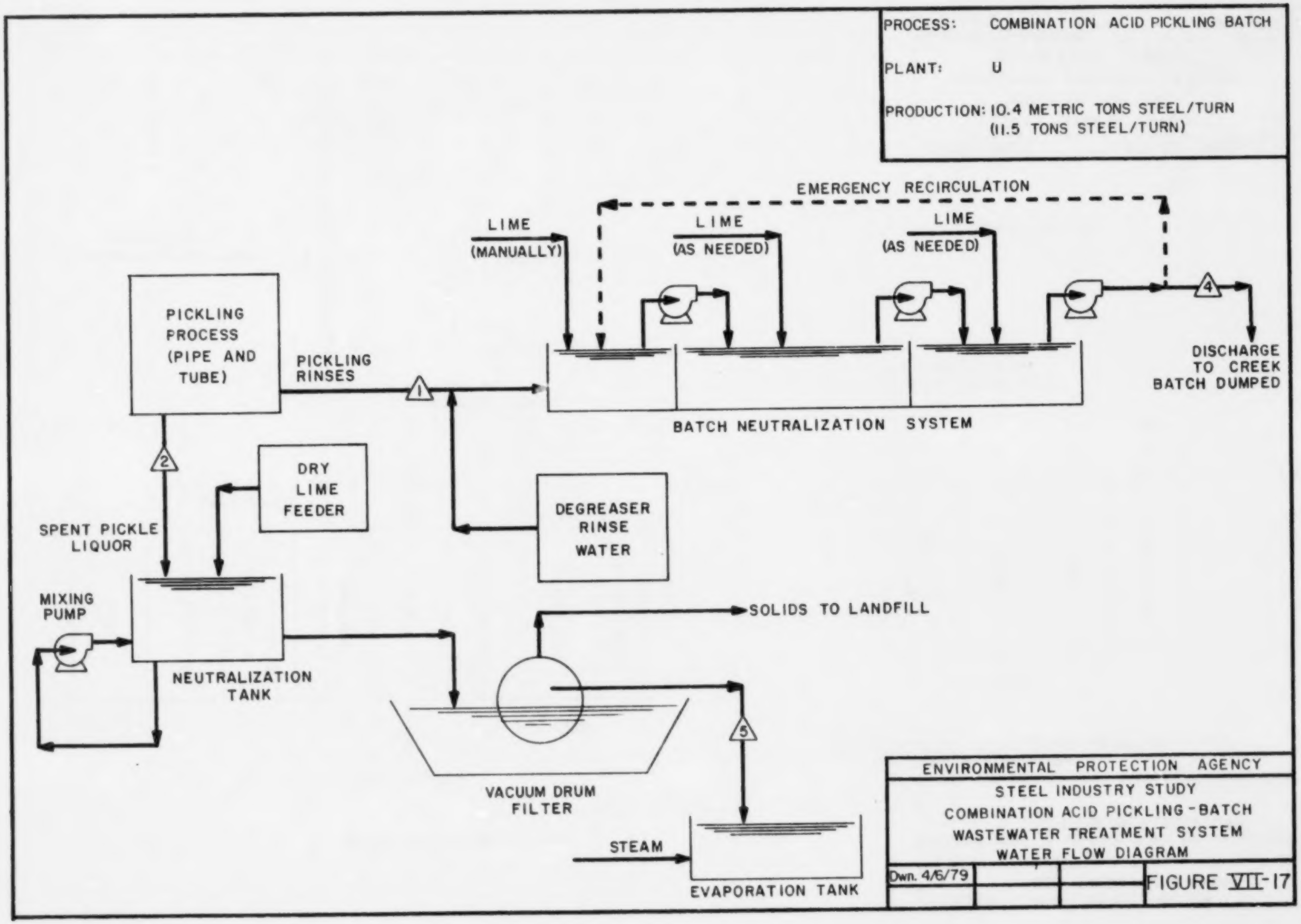
FIGURE VII-15


PROCESS: PICKLING H_2SO_4 CONTINUOUS-CONCENTRATED AND RINSES PICKLING-SULFURIC ACID RECOVERY
PLANT: T-2
PRODUCTION: 91 METRIC TONS OF STEEL/TURN (100 TONS OF STEEL/TURN)
EXHAUST TO ATMOSPHERE 0.28 ℓ/SEC. H_2O VAPOR (4.5 GPM H_2O VAPOR)
EXHAUST TO ATMOSPHERE
22,700 ℓ (6000 GAL.)
PICKLING TANK
RINSE TANK
RINSE TANK
SPENT PICKLE LIQUOR
CONDENSATE RINSE WATER 0.28ℓ/SEC. (4.5 GPM-HOT)
0.28 ℓ/SEC. (4.5GPM)
1 METERED FLOW
RINSE WATER COLLECTOR TANK
2 CITY WATER (USED TO GENERATE STEAM)
STEAM
STEAM
STEAM CONDENSATE .28ℓ/SEC. (4.5GPM HOT)
RECOVERED ACID STORAGE TANK
FROM ACID RECOVERY UNIT
NEW ACID STORAGE TANK
CONDITIONING TANK (2) 22,700 ℓ (6000 GAL.)
NON-CONTACT COOLANT TO SEWER
TO CRYSTALLIZER TANK OF ACID RECOVERY UNIT ACID CONC. 15-20% BY EVAPORATIVE CONCENTRATION
△= SAMPLING POINTS
DWG. 3-16-74
REV.1 2-20-76
REV.2 2-25-76

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
CONTINUOUS STRIP PICKLING
WASTE WATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-16



PROCESS: COMBINATION ACID PICKLING BATCH

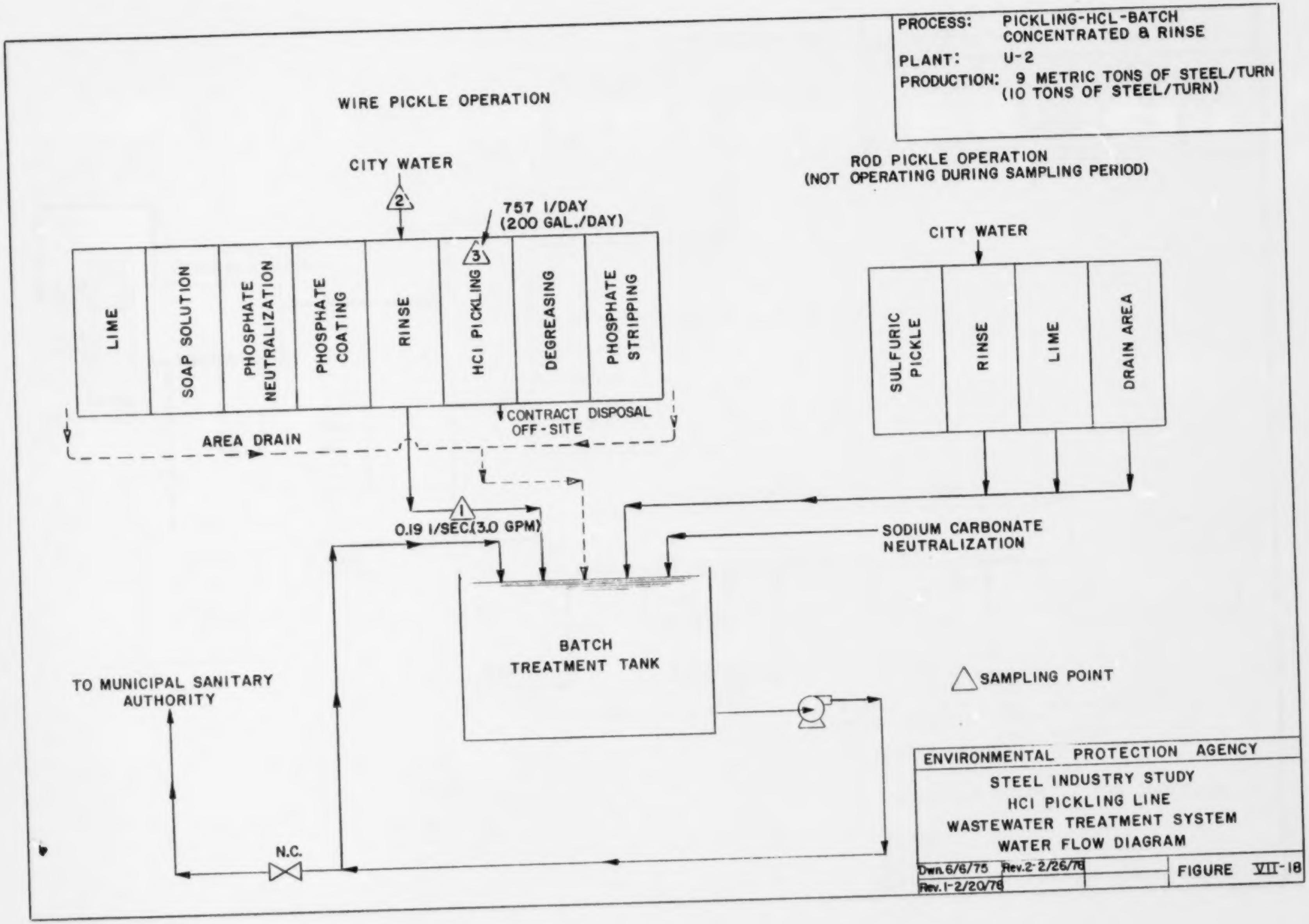
PLANT: U

PRODUCTION: 10.4 METRIC TONS STEEL/TURN
(11.5 TONS STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING - BATCH
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 4/6/79

FIGURE VII-17



PROCESS: PICKLING-HCL-BATCH CONCENTRATED & RINSE
PLANT: U-2
PRODUCTION: 9 METRIC TONS OF STEEL/TURN (10 TONS OF STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HCl PICKLING LINE
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

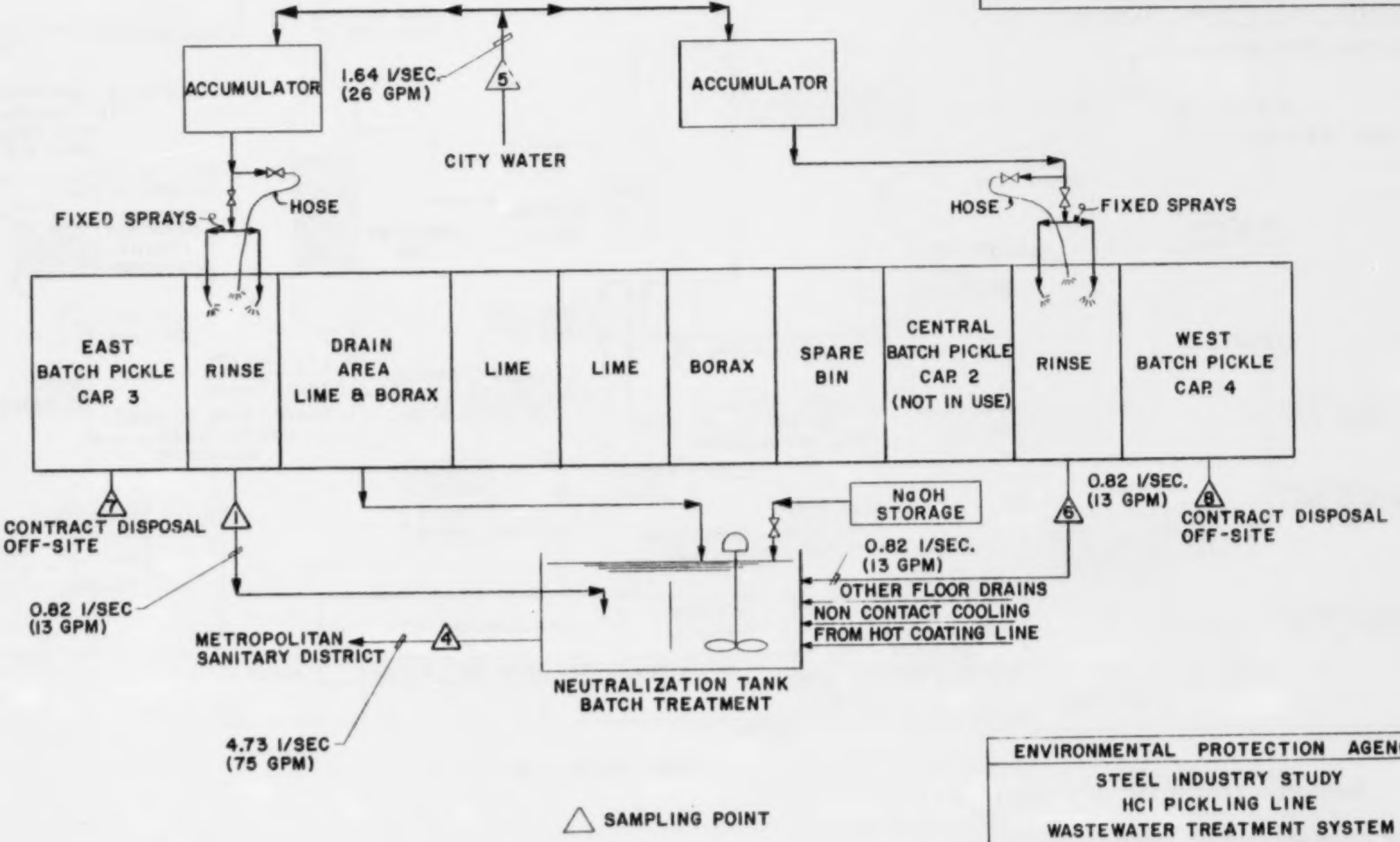
Dwn. 6/6/75 Rev. 2-2/26/76
Rev. 1-2/20/76

FIGURE VII-18

PROCESS: PICKLING HCl-BATCH CONCENTRATED & RINSE

PLANT: V-2

PRODUCTION: 72 METRIC TONS OF STEEL/TURN
(79 TONS OF STEEL/TURN)



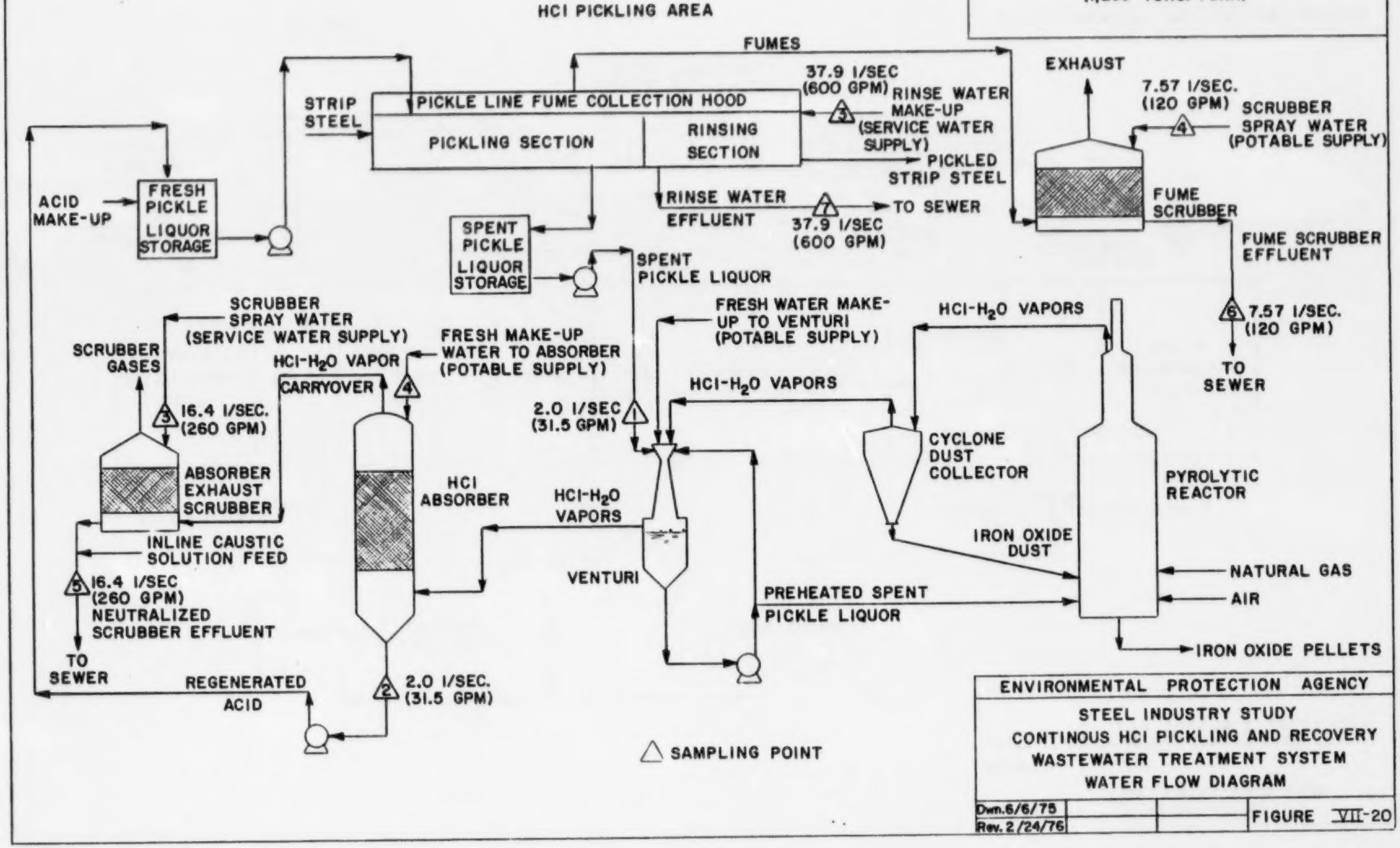
ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCl PICKLING LINE
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 6/6/75 Rev. 2/27/76
Rev. 2/20/76

FIGURE VII-19

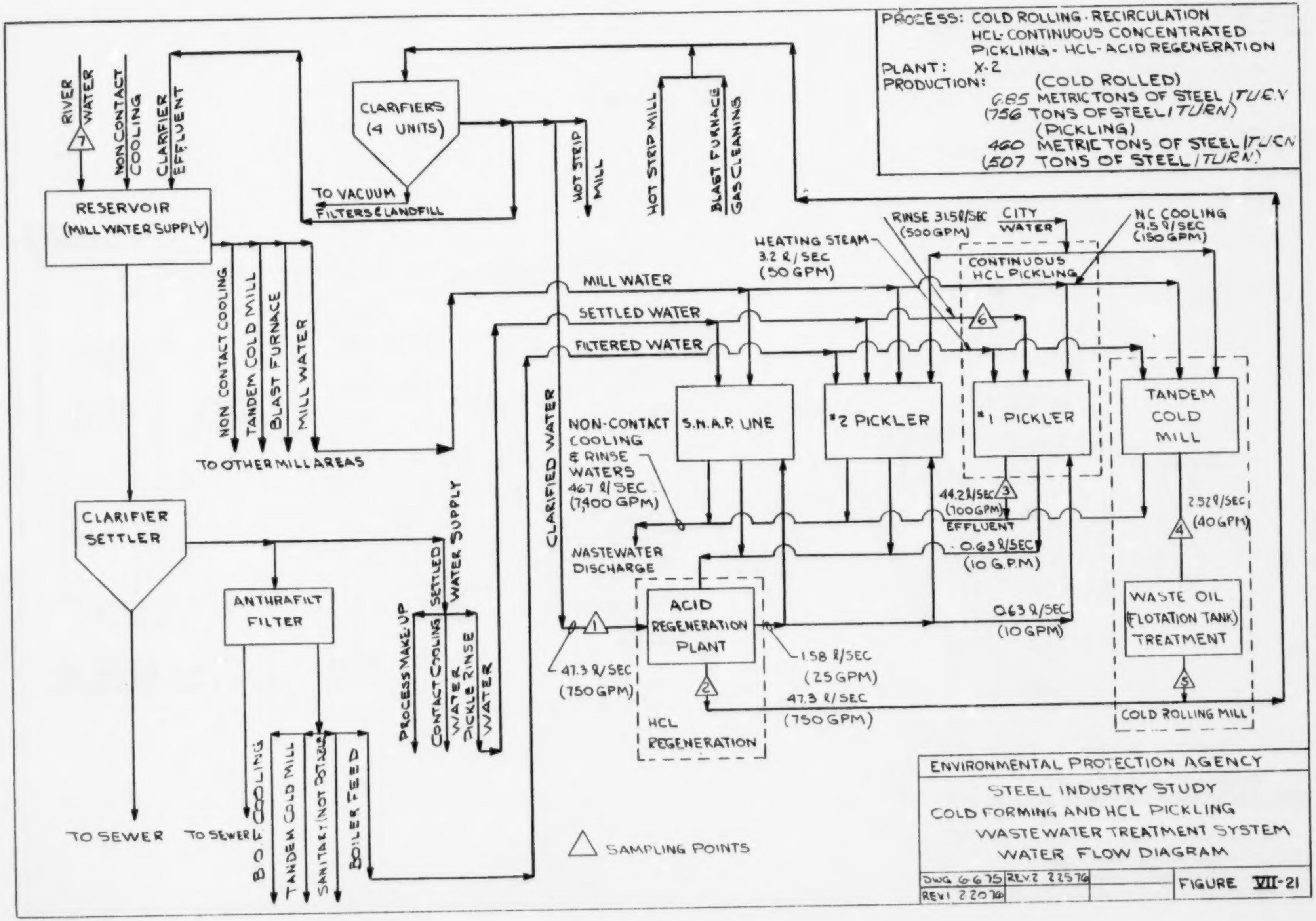
PROCESS: PICKLING-HCl-CONCENTRATED AND RINSE, PICKLING-HCl REGENERATION
TYPE: PYROLYTIC HCl REGENERATION
PLANT: W-2
PRODUCTION: 1,148 METRIC TONS/TURN (1,266 TONS/TURN)



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
CONTINOUS HCl PICKLING AND RECOVERY
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 6/6/75
Rev. 2/24/76

FIGURE VII-20

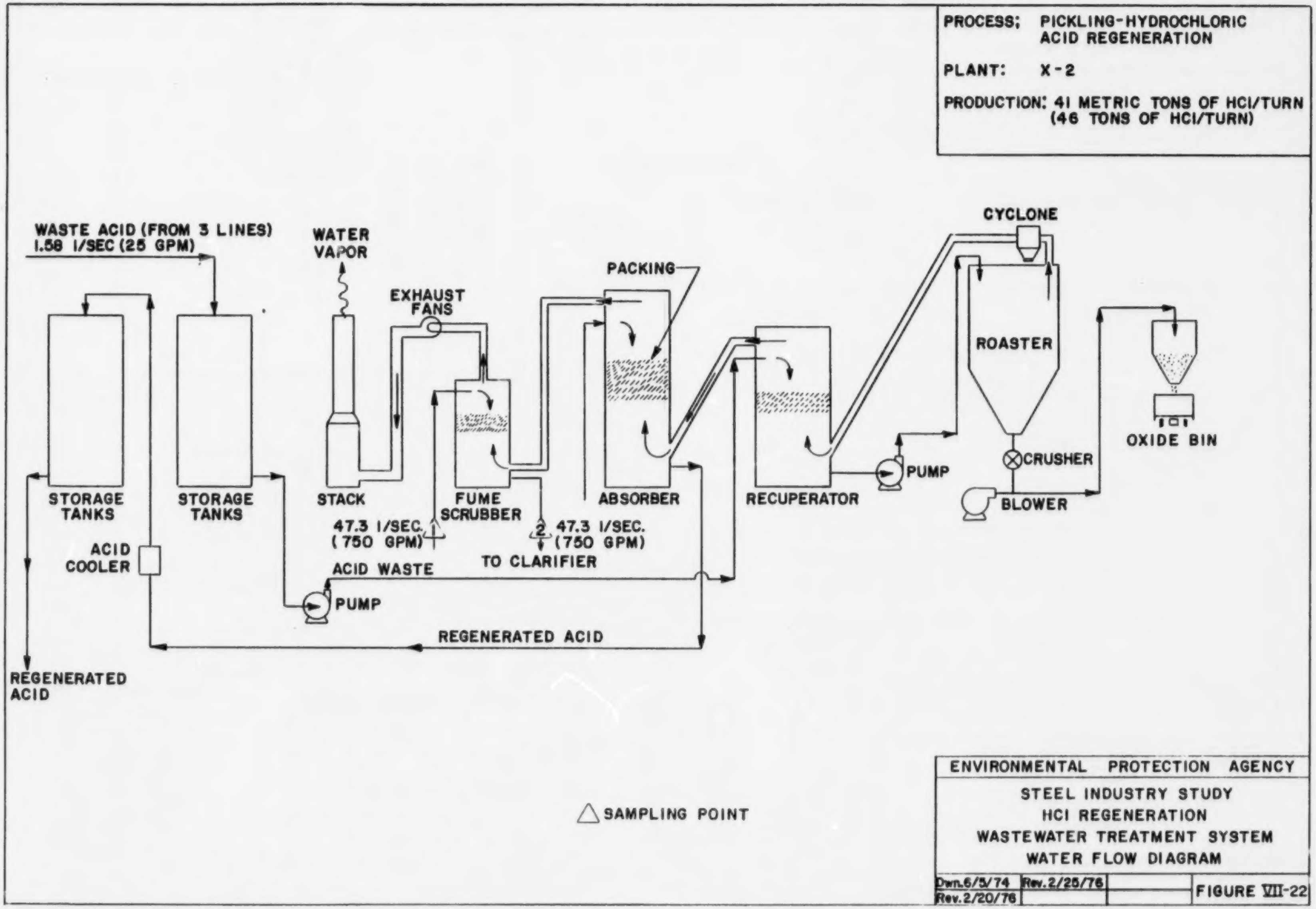


PROCESS: COLD ROLLING - RECIRCULATION
HCL- CONTINUOUS CONCENTRATED
PICKLING - HCL- ACID REGENERATION
PLANT: X-2
PRODUCTION: (COLD ROLLED)
685 METRIC TONS OF STEEL/TURN
(756 TONS OF STEEL/TURN)
(PICKLING)
460 METRIC TONS OF STEEL/TURN
(507 TONS OF STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COLD FORMING AND HCL PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG 6-6-75 REV.2 2-25-76
REV.1 2-20-76

FIGURE VII-21



PROCESS; PICKLING-HYDROCHLORIC ACID REGENERATION

PLANT: X-2

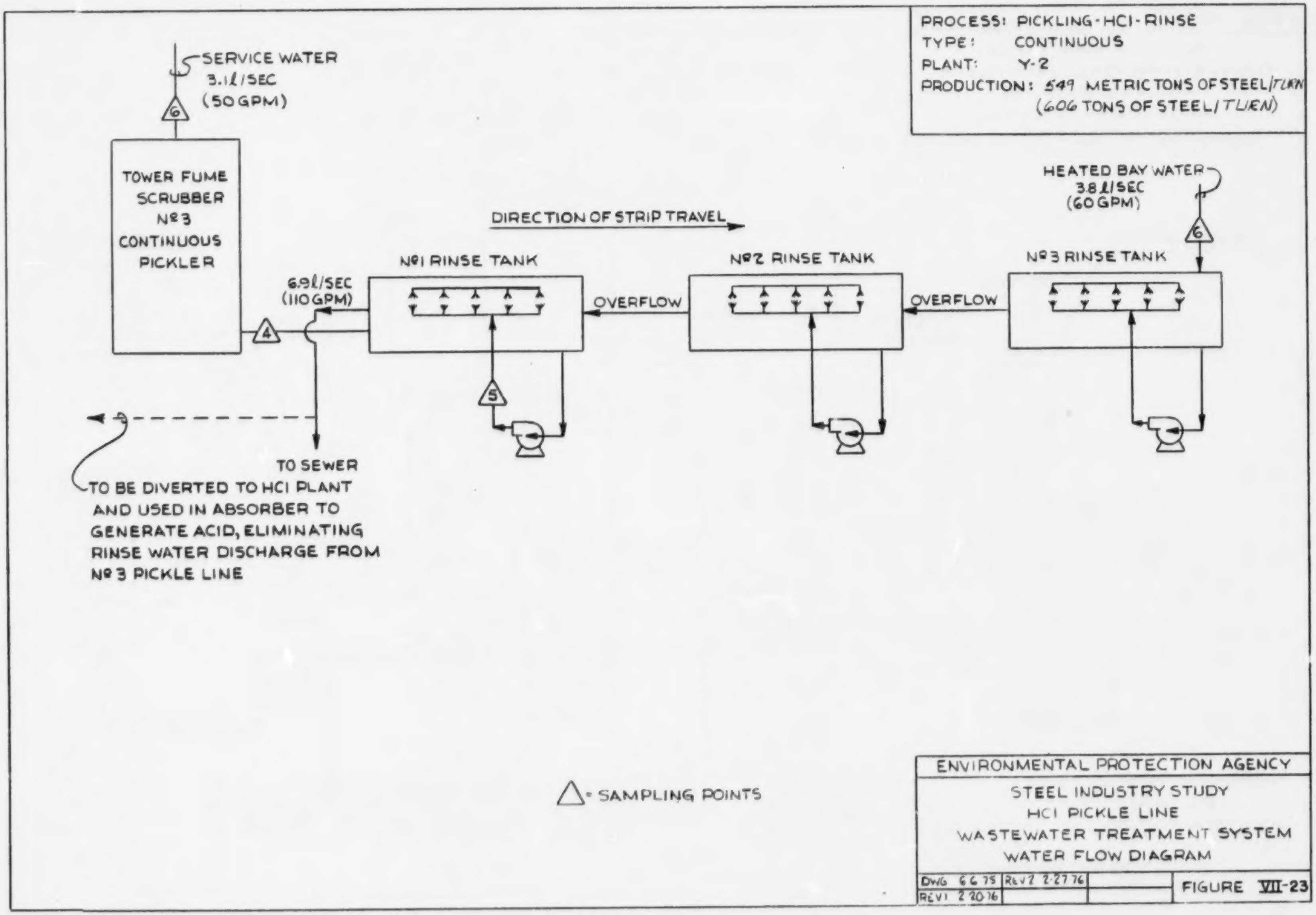
PRODUCTION: 41 METRIC TONS OF HCl/TURN (46 TONS OF HCl/TURN)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCl REGENERATION
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 6/5/74	Rev. 2/25/76	
Rev. 2/20/76		

FIGURE VII-22



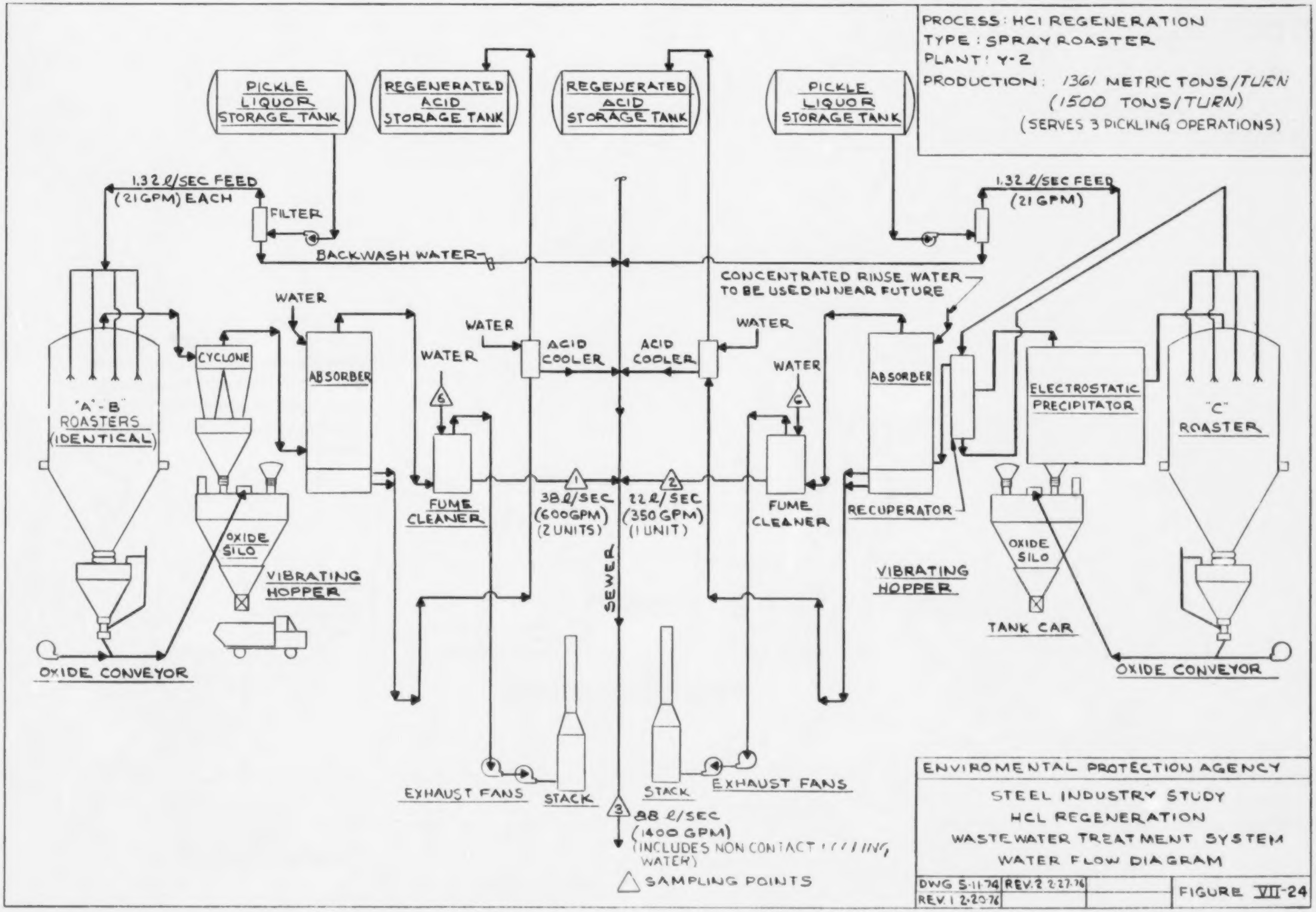
PROCESS: PICKLING - HCl - RINSE
TYPE: CONTINUOUS
PLANT: Y-2
PRODUCTION: 549 METRIC TONS OF STEEL/TURN
(606 TONS OF STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCl PICKLE LINE
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG 6 6 75 REV 2 2-27-76
REV 1 2-20-76

FIGURE VII-23


PROCESS: HCl REGENERATION
TYPE: SPRAY ROASTER
PLANT: Y-2
PRODUCTION: 1361 METRIC TONS/TURN
(1500 TONS/TURN)
(SERVES 3 PICKLING OPERATIONS)
PICKLE LIQUOR STORAGE TANK
REGENERATED ACID STORAGE TANK
REGENERATED ACID STORAGE TANK
PICKLE LIQUOR STORAGE TANK
1.32 ℓ/SEC FEED (21GPM) EACH
FILTER
BACKWASH WATER
1.32 ℓ/SEC FEED (21GPM)
CONCENTRATED RINSE WATER TO BE USED IN NEAR FUTURE
WATER
WATER
WATER
WATER
WATER
WATER
"A"-"B" ROASTERS (IDENTICAL)
CYCLONE
ABSORBER
ACID COOLER
ACID COOLER
ABSORBER
ELECTROSTATIC PRECIPITATOR
"C" ROASTER
6
6
FUME CLEANER
1
38ℓ/SEC (600GPM) (2 UNITS)
2
22ℓ/SEC (350 GPM) (1 UNIT)
FUME CLEANER
RECUPERATOR
OXIDE SILO
VIBRATING HOPPER
SEWER
VIBRATING HOPPER
OXIDE SILO
TANK CAR
OXIDE CONVEYOR
OXIDE CONVEYOR
EXHAUST FANS
STACK
STACK
EXHAUST FANS
3
88 ℓ/SEC (1400 GPM) (INCLUDES NON CONTACT COOLING WATER)
SAMPLING POINTS

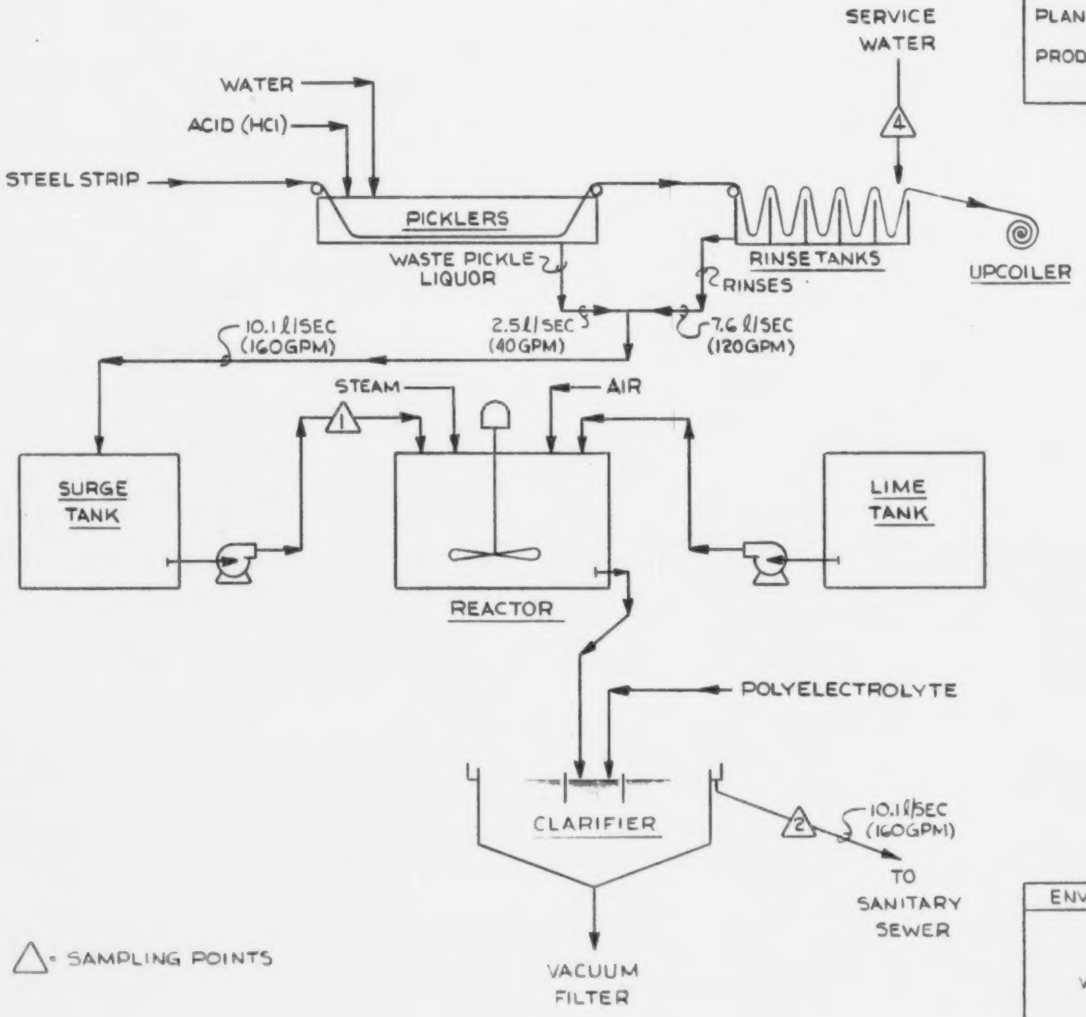
ENVIROMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCL REGENERATION
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG 5-11-74 REV. 2 2-27-76
REV. 1 2-20-76

FIGURE VII-24

PROCESS: PICKLING HCl CONTINUOUS
CONCENTRATED & RINSE
PLANT: Z-2
PRODUCTION: 420 METRIC TONS OF STEEL/TURN
(463 TONS OF STEEL/TURN)

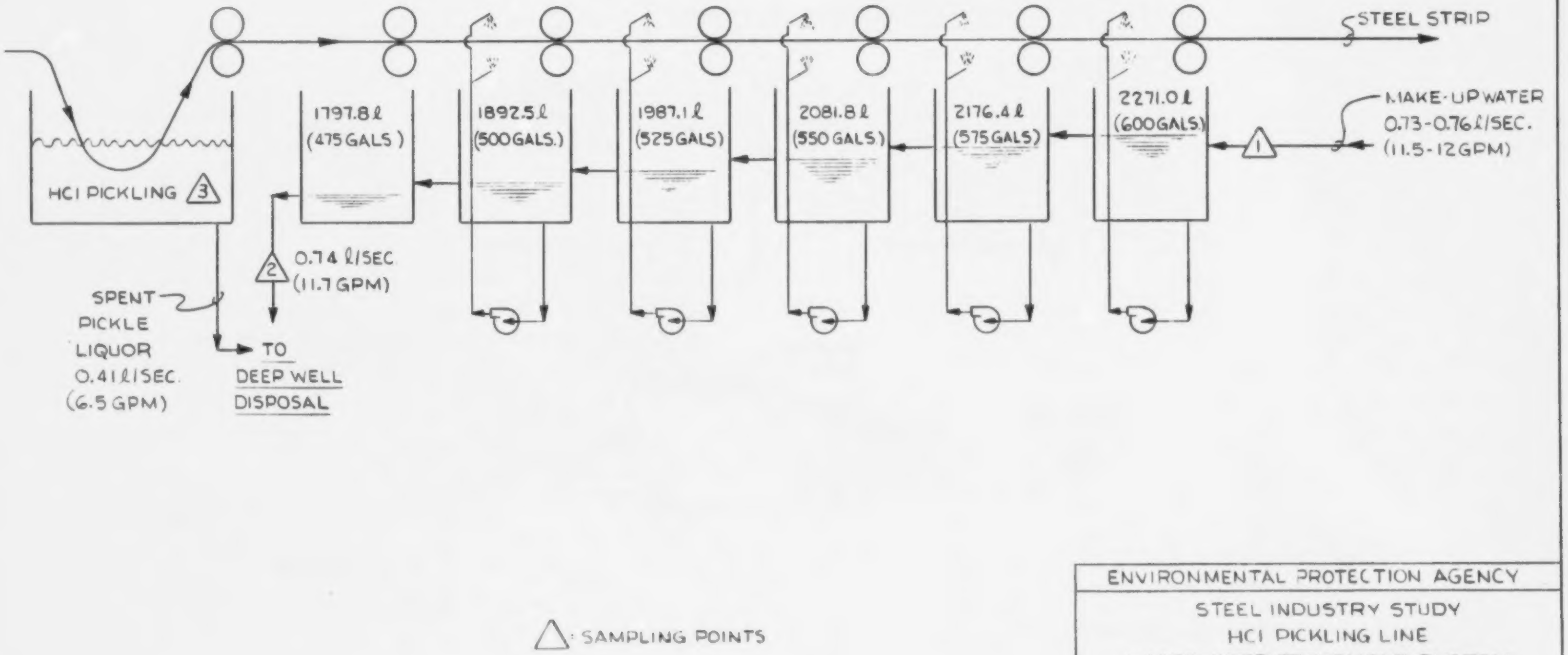


ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HCl PICKLING LINE
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG 6 6 75 REV 2 2-27 76
REV 1 2 19 76

FIGURE VII-25

PROCESS: PICKLING - HCl CONTINUOUS
CONCENTRATED & RINSE
PLANT: AA-2
PRODUCTION: 871 METRIC TONS OF STEEL/TURN
(960 TONS OF STEEL/TURN)

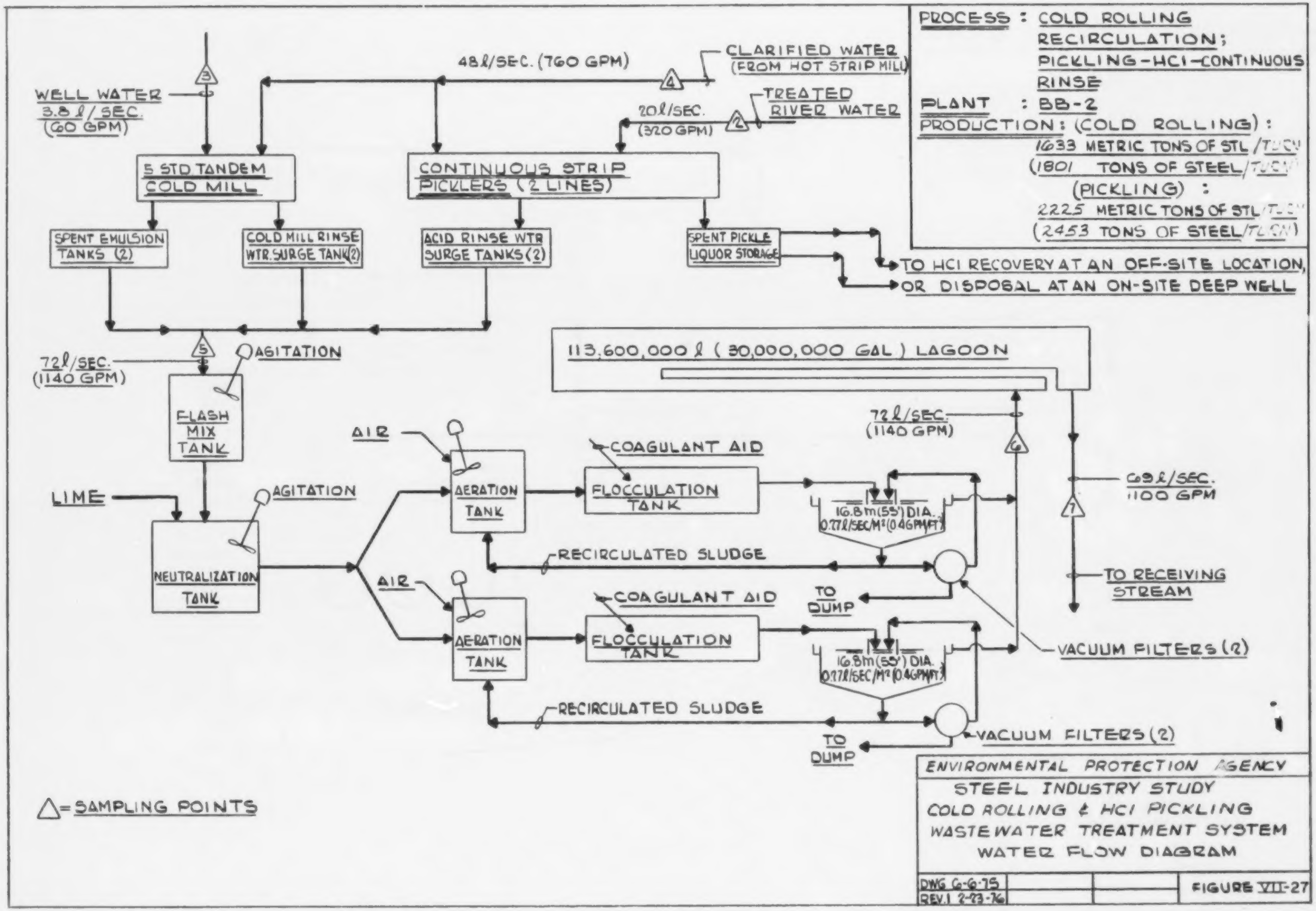


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HCl PICKLING LINE
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG 6 6 75 | REV 2 2 27 76
REV 1 2 20 76

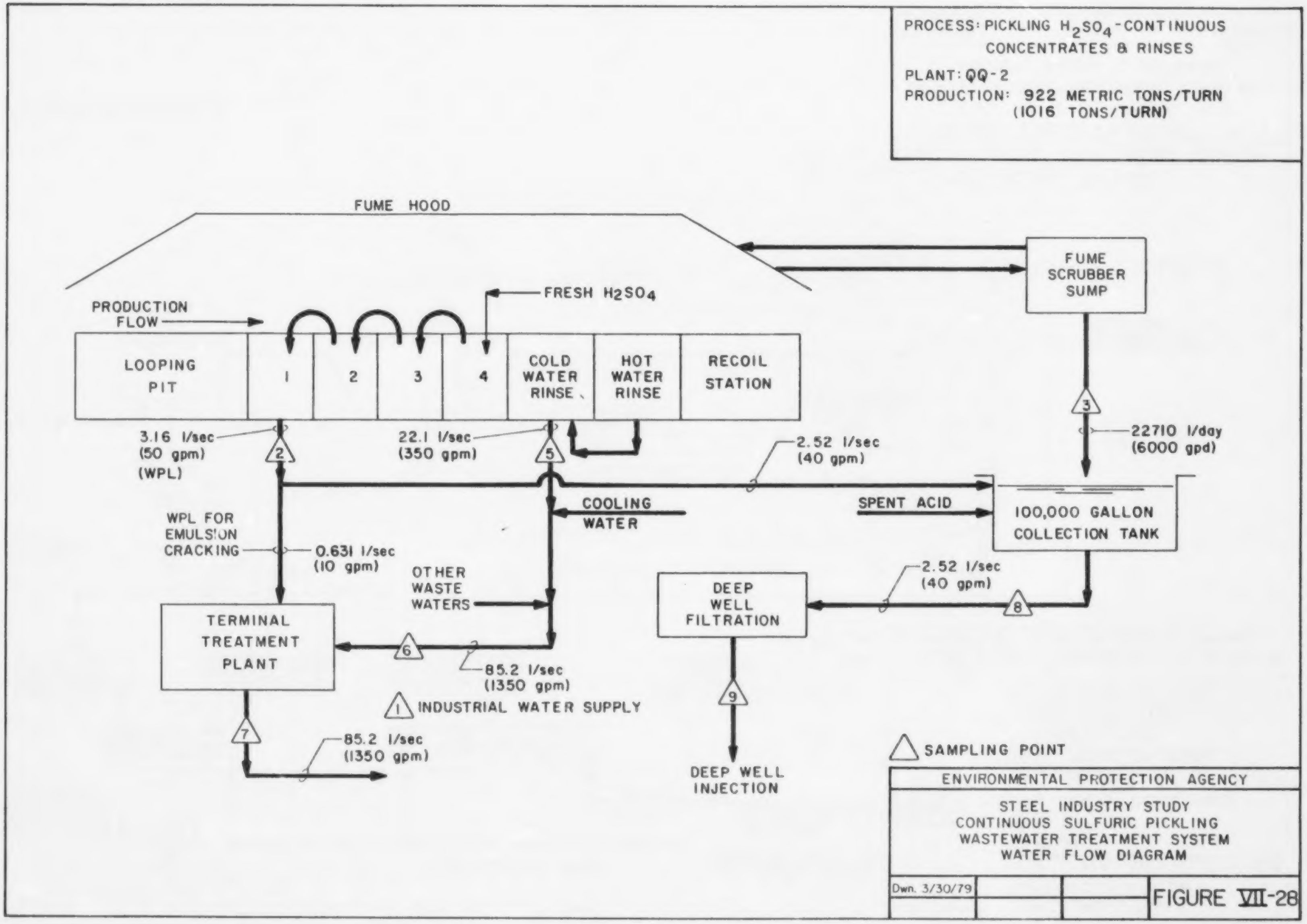
FIGURE VII-26



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COLD ROLLING & HCl PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-27



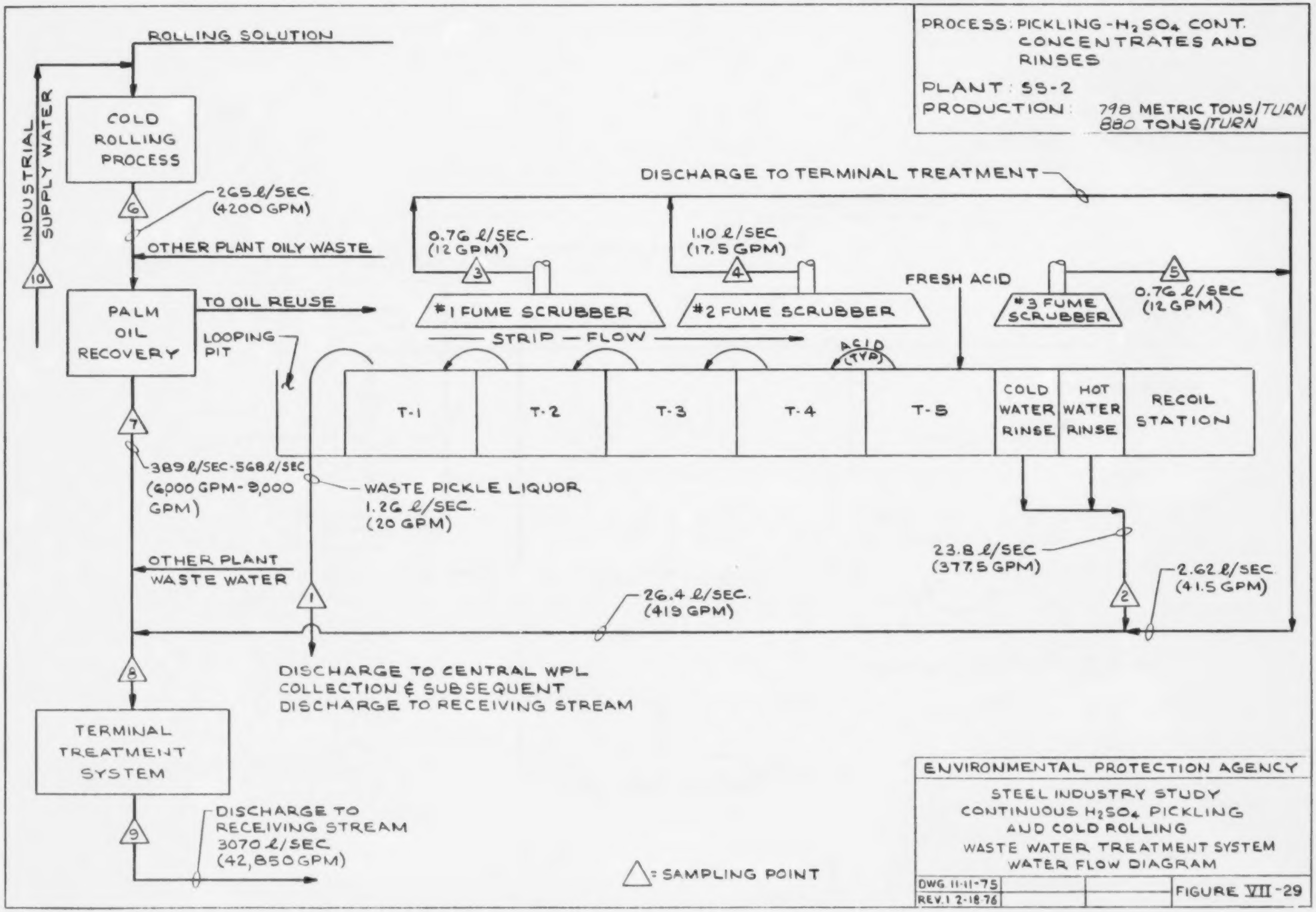
PROCESS: PICKLING H_2SO_4-CONTINUOUS CONCENTRATES & RINSES
PLANT: QQ-2
PRODUCTION: 922 METRIC TONS/TURN (1016 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
CONTINUOUS SULFURIC PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/30/79

FIGURE VII-28



ENVIRONMENTAL PROTECTION AGENCY

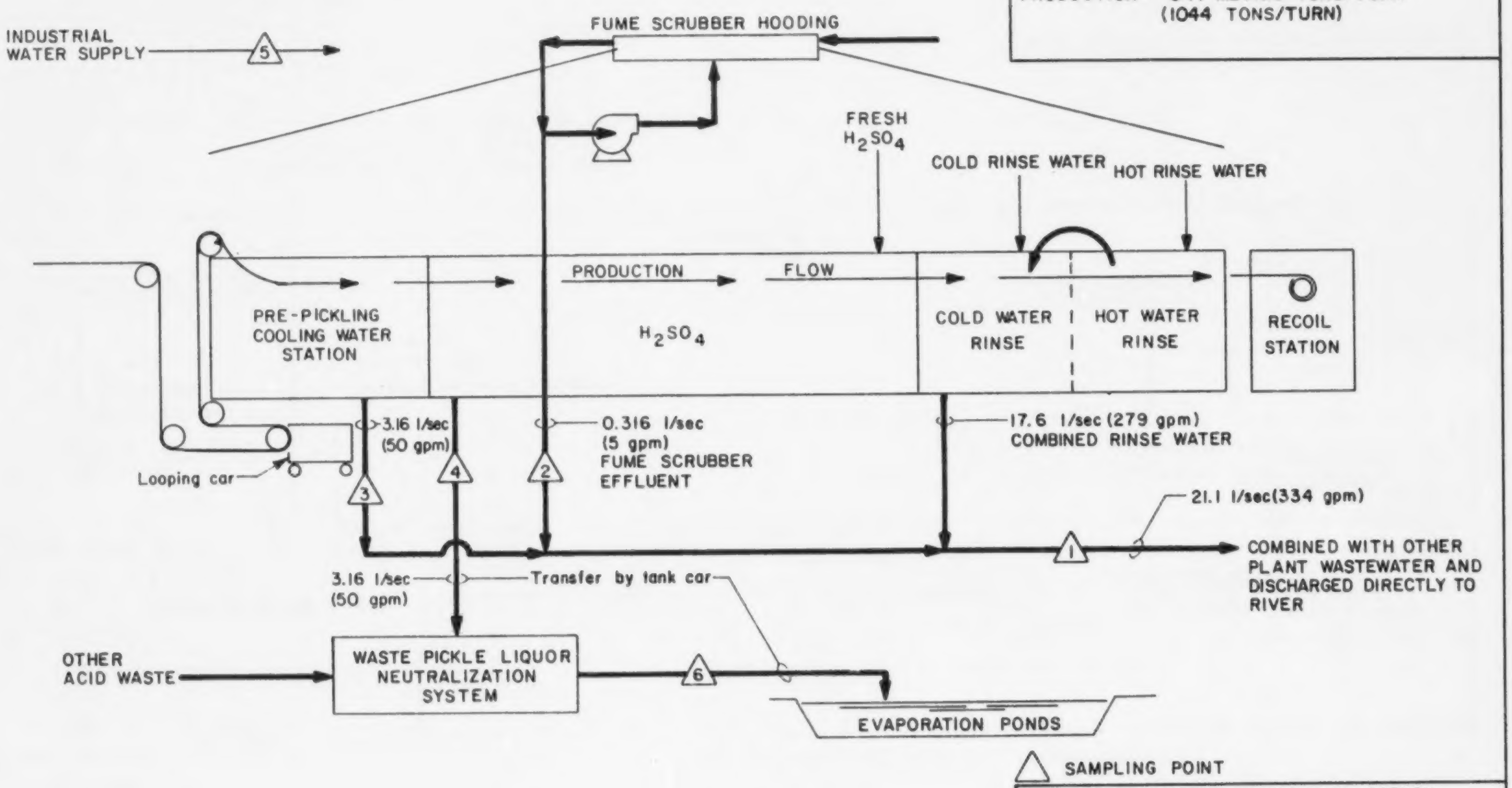
STEEL INDUSTRY STUDY
CONTINUOUS H_2SO_4 PICKLING
AND COLD ROLLING
WASTE WATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-29

PROCESS: PICKLING - H_2SO_4 - CONTINUOUS
CONCENTRATES - RINSES

PLANT: TT-2

PRODUCTION: 947 METRIC TONS/TURN
(1044 TONS/TURN)



△ SAMPLING POINT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
CONTINUOUS SULFURIC PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

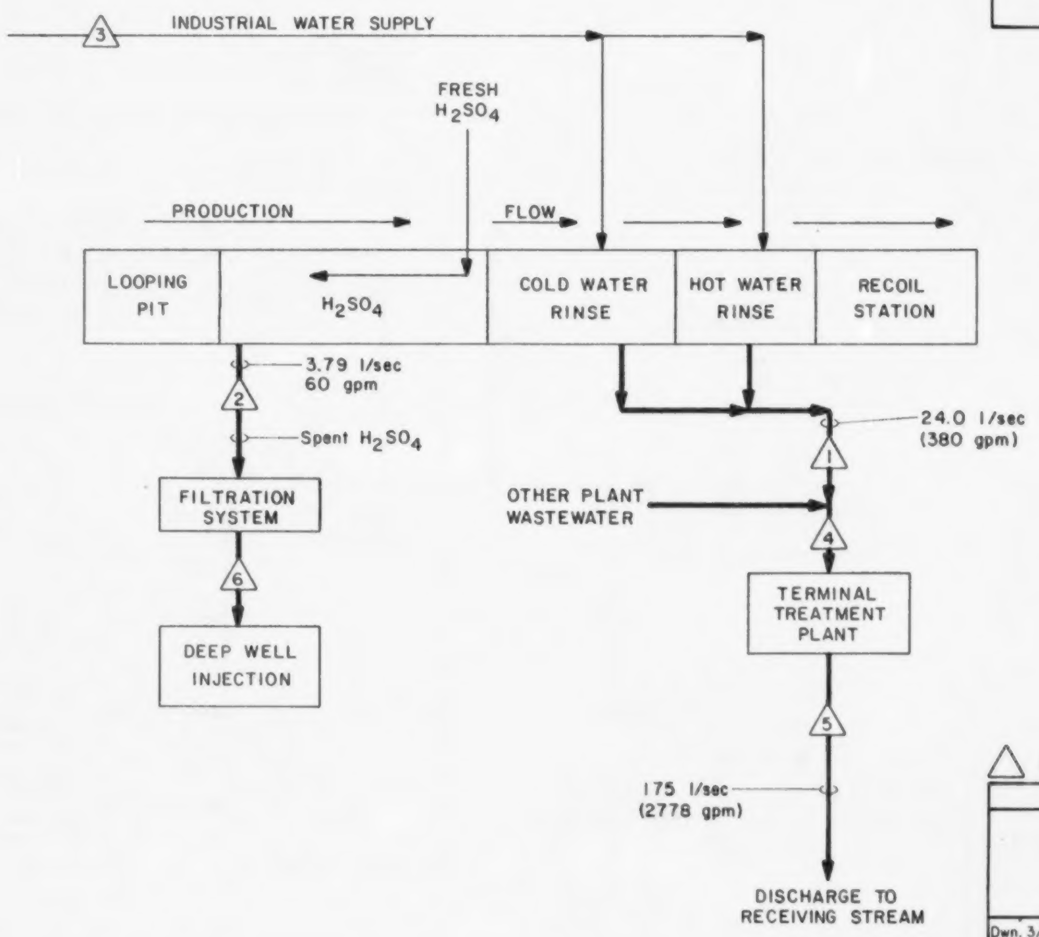
Dwn. 3/29/79

FIGURE VII-30

PROCESS: PICKLING H_2SO_4 CONTINUOUS
CONCENTRATES & RINSES

PLANT: WW-2

PRODUCTION: 584 METRIC TONS/TURN
(644 TONS/TURN)



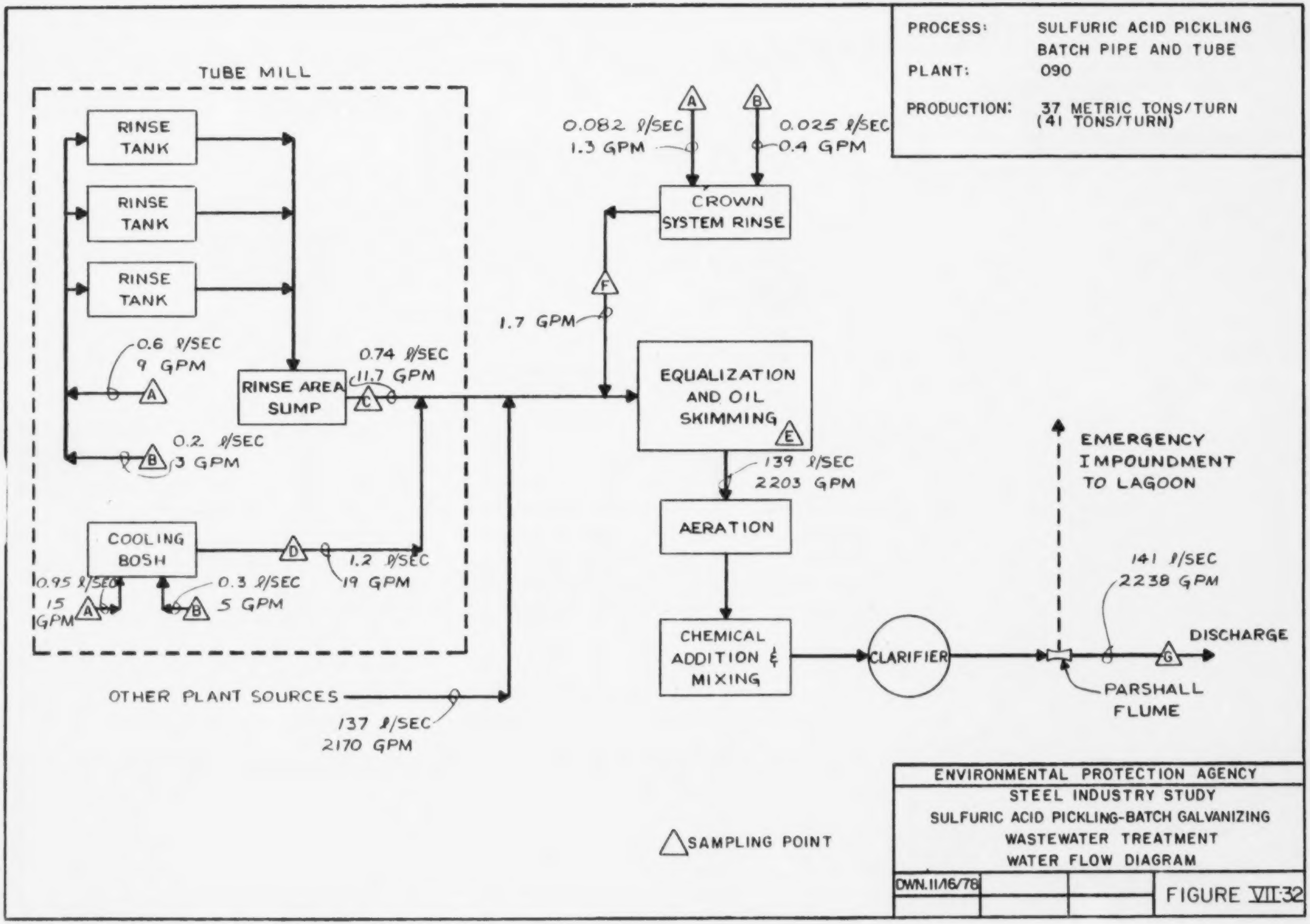
△ SAMPLING POINT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
CONTINUOUS SULFURIC PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

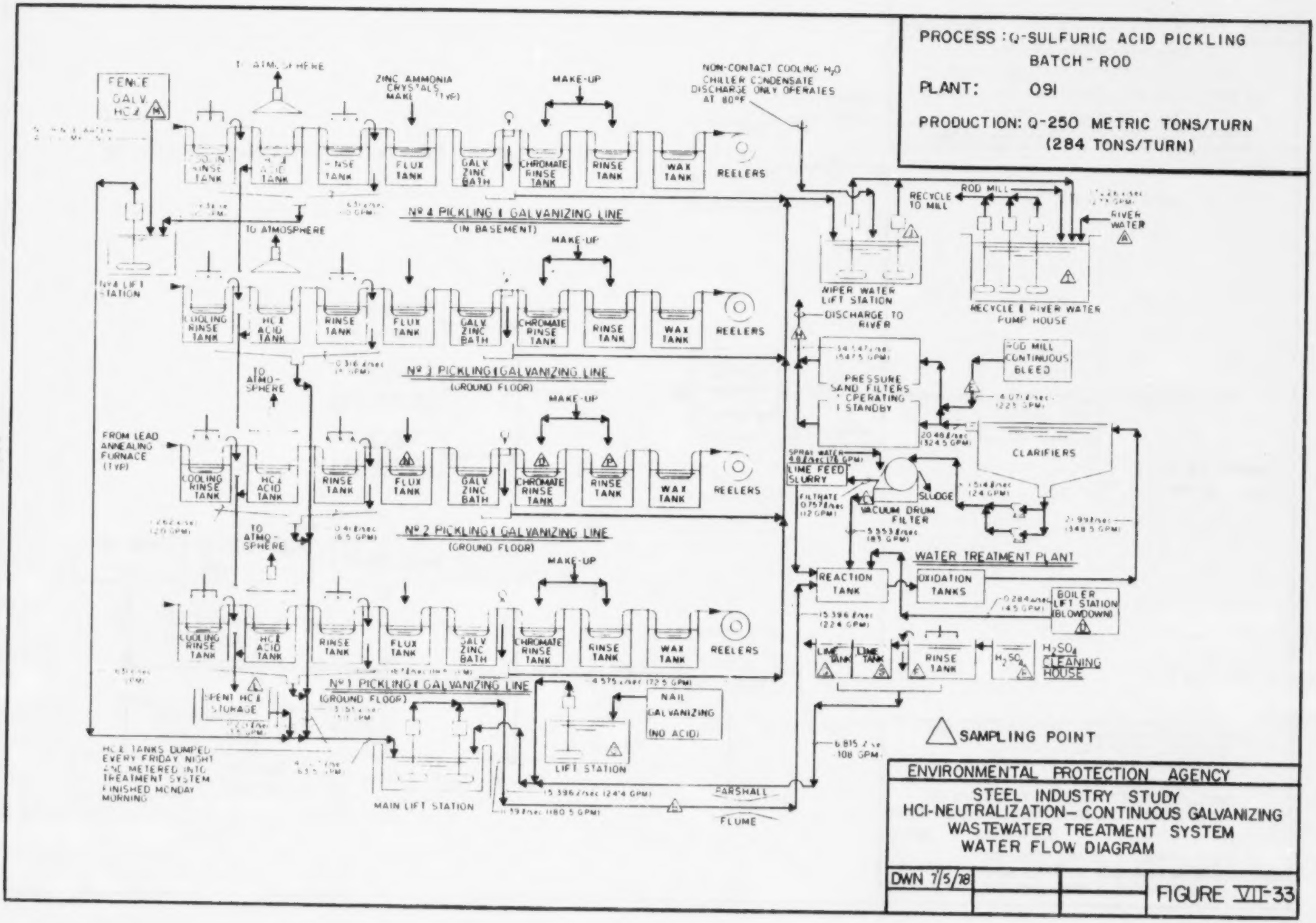
Dwn. 3/29/79

FIGURE VII-31



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING-BATCH GALVANIZING
WASTEWATER TREATMENT
WATER FLOW DIAGRAM

FIGURE VII-32



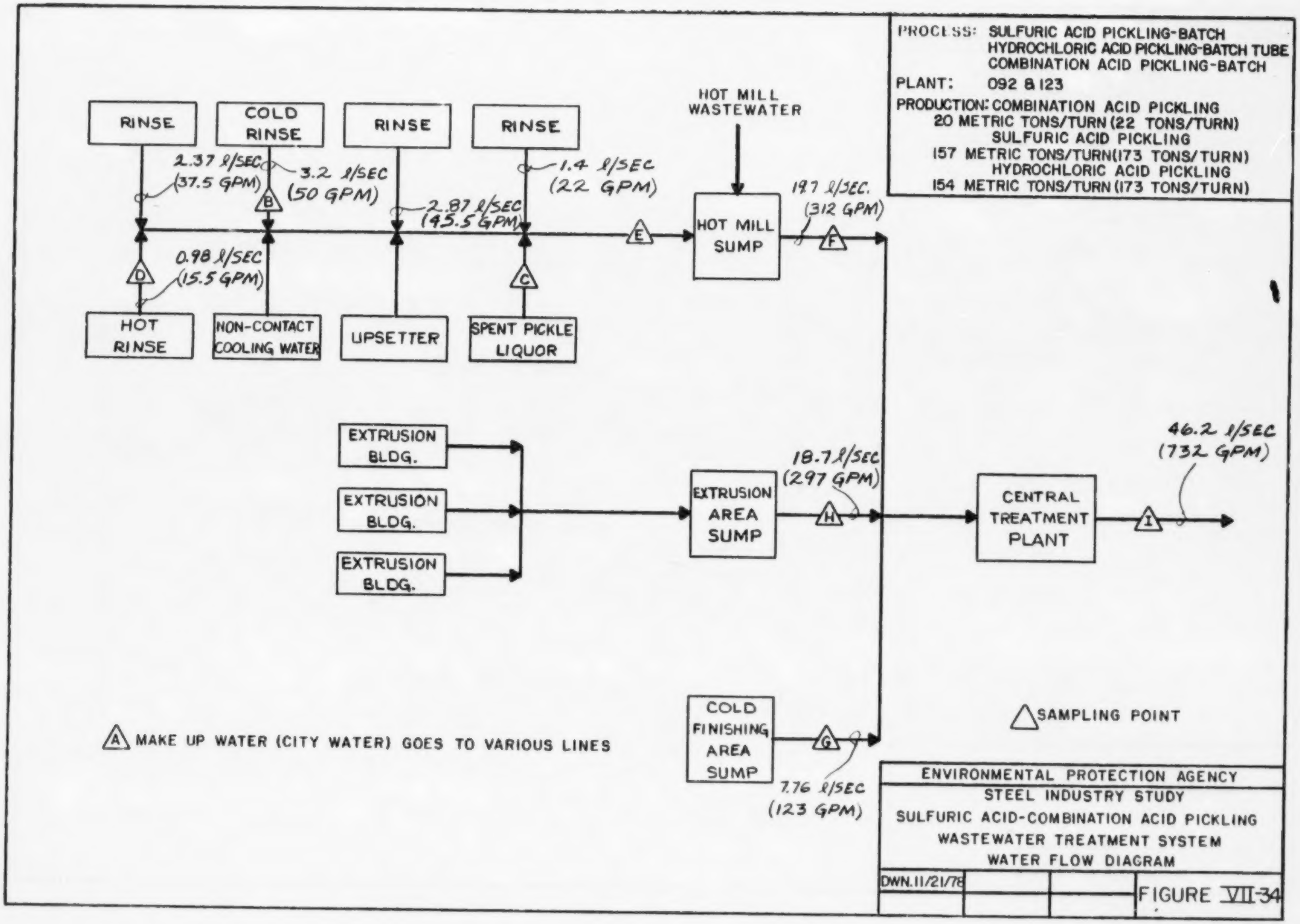
PROCESS: Q-SULFURIC ACID PICKLING
BATCH - ROD
PLANT: 091
PRODUCTION: Q-250 METRIC TONS/TURN
(284 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HCl-NEUTRALIZATION– CONTINUOUS GALVANIZING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWN 7/5/78

FIGURE VII-33

PROCESS: SULFURIC ACID PICKLING-BATCH
HYDROCHLORIC ACID PICKLING-BATCH TUBE
COMBINATION ACID PICKLING-BATCH
PLANT: 092 & 123
PRODUCTION: COMBINATION ACID PICKLING
20 METRIC TONS/TURN (22 TONS/TURN)
SULFURIC ACID PICKLING
157 METRIC TONS/TURN (173 TONS/TURN)
HYDROCHLORIC ACID PICKLING
154 METRIC TONS/TURN (173 TONS/TURN)

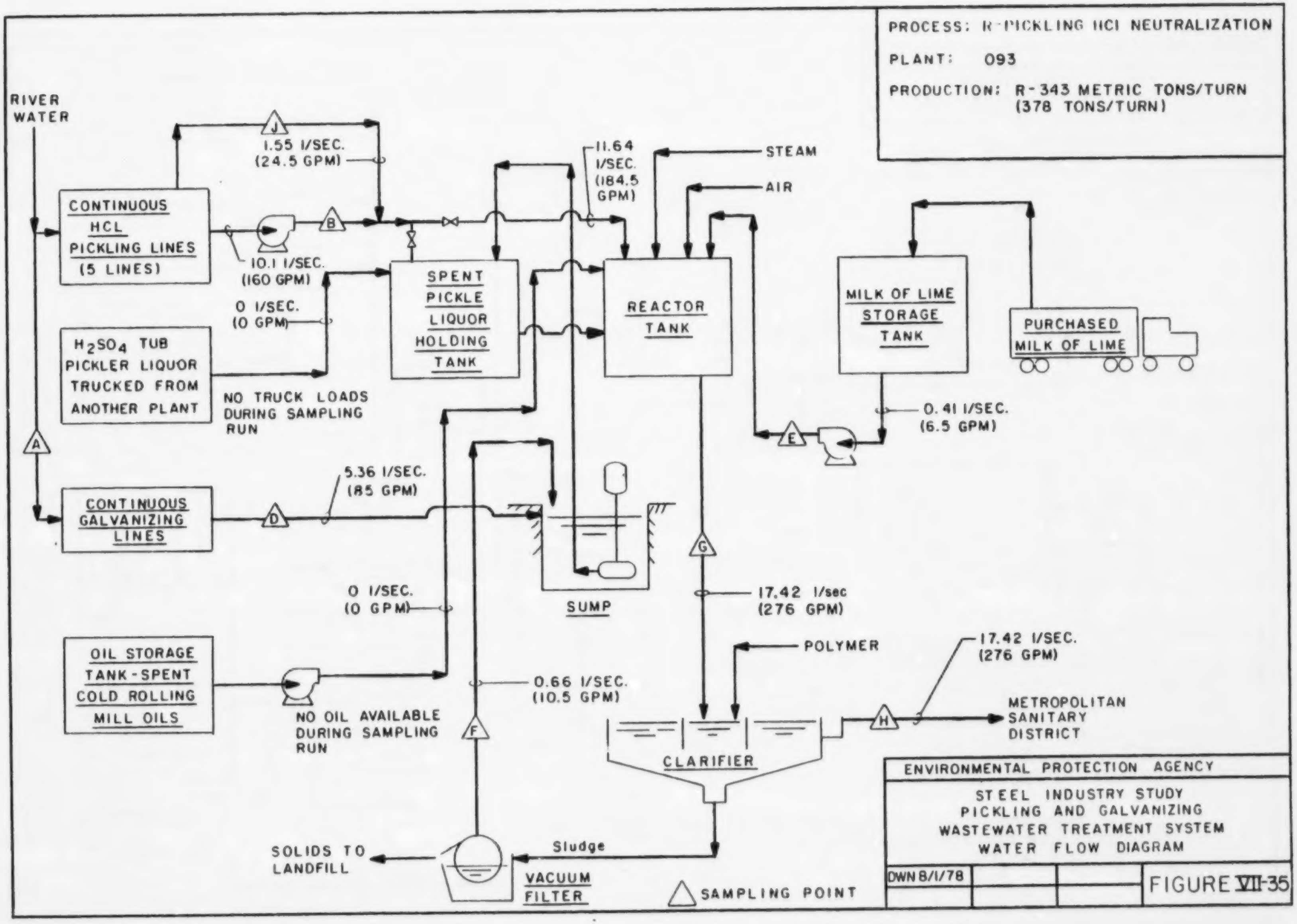


△ SAMPLING POINT

A MAKE UP WATER (CITY WATER) GOES TO VARIOUS LINES

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID-COMBINATION ACID PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM
DWN. 11/21/78

FIGURE VII-34



PROCESS: R-PICKLING HCl NEUTRALIZATION

PLANT: 093

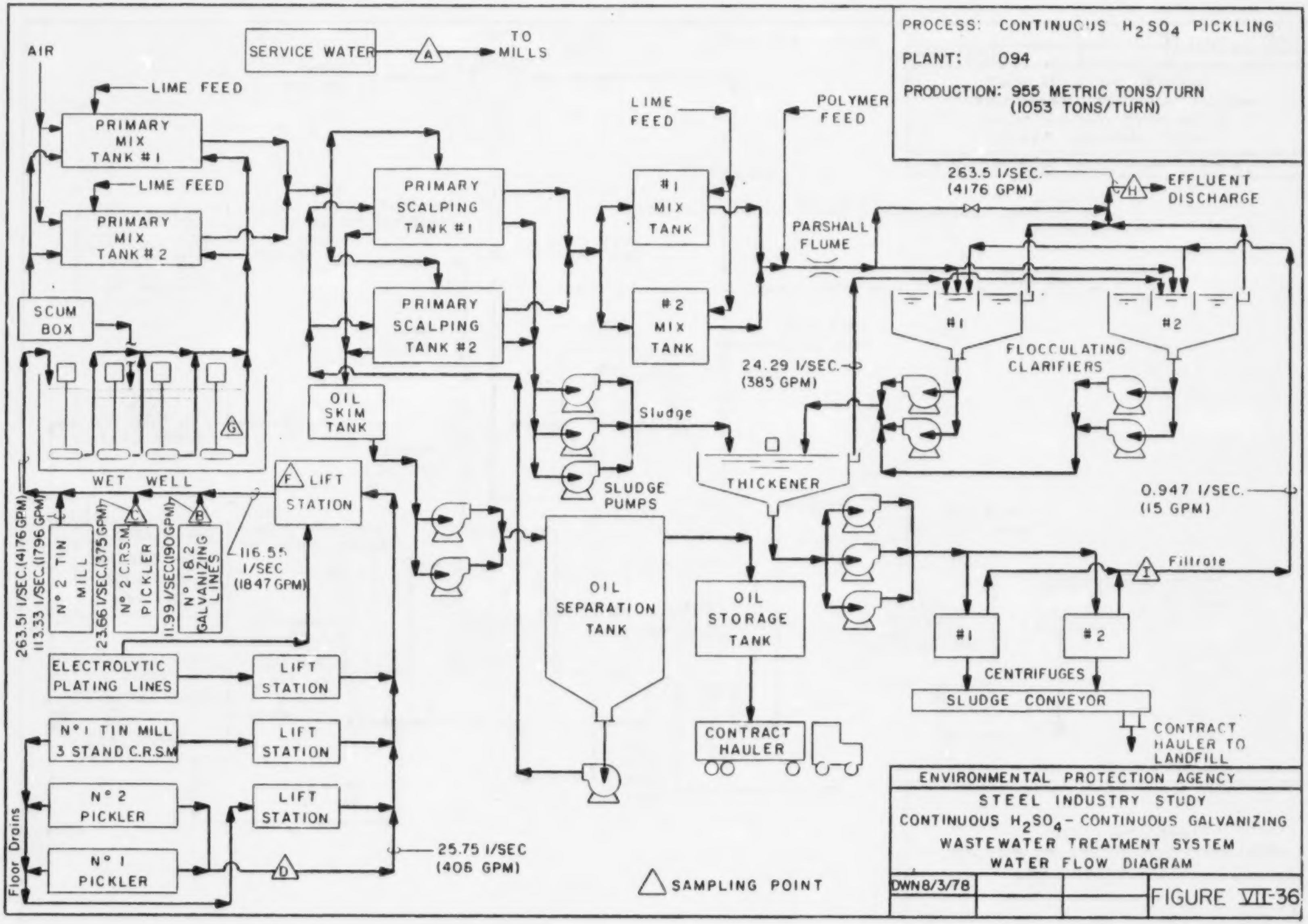
PRODUCTION: R-343 METRIC TONS/TURN
(378 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
PICKLING AND GALVANIZING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

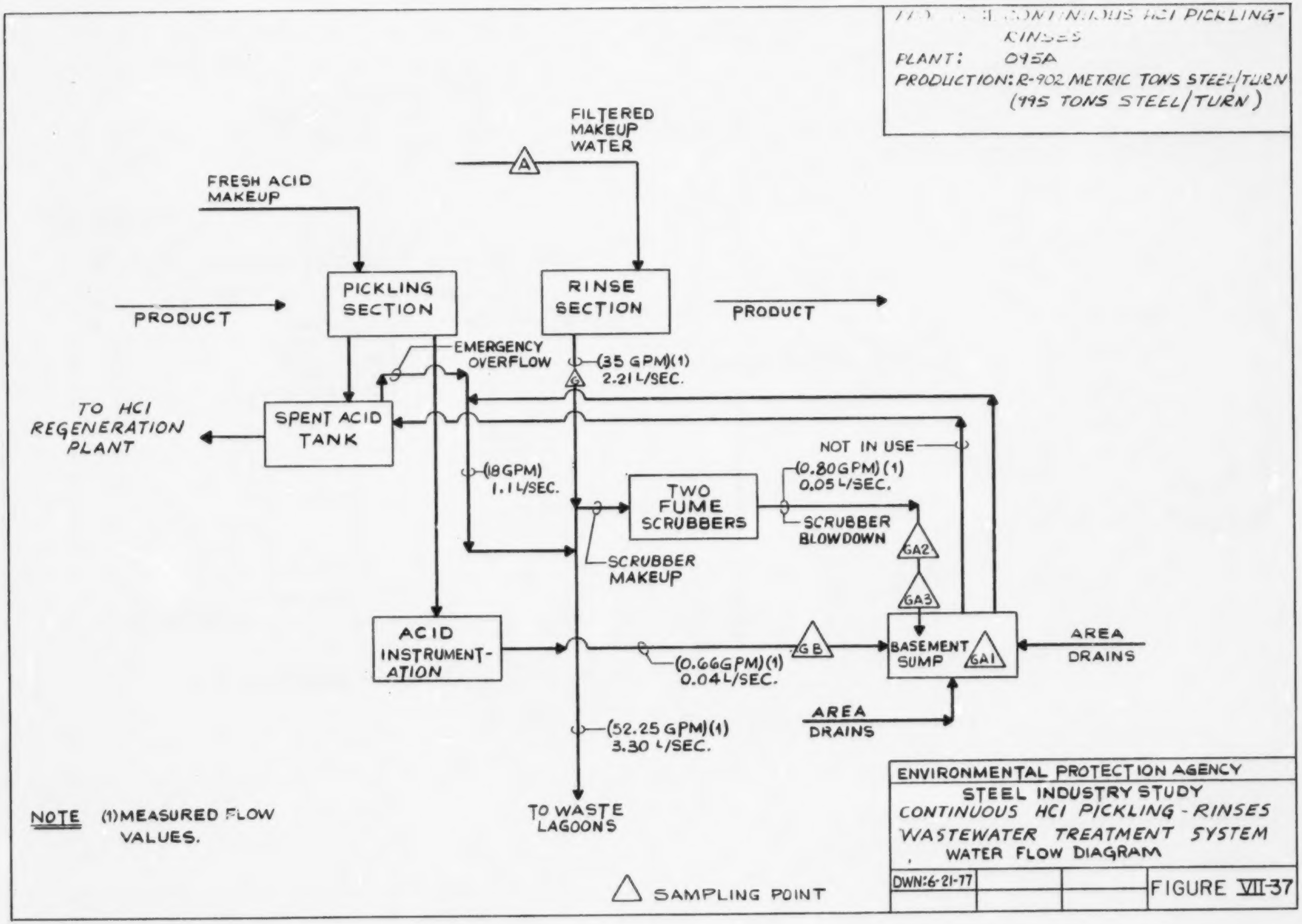
DWN 8/1/78

FIGURE VII-35



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
CONTINUOUS H_2SO_4 - CONTINUOUS GALVANIZING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-36

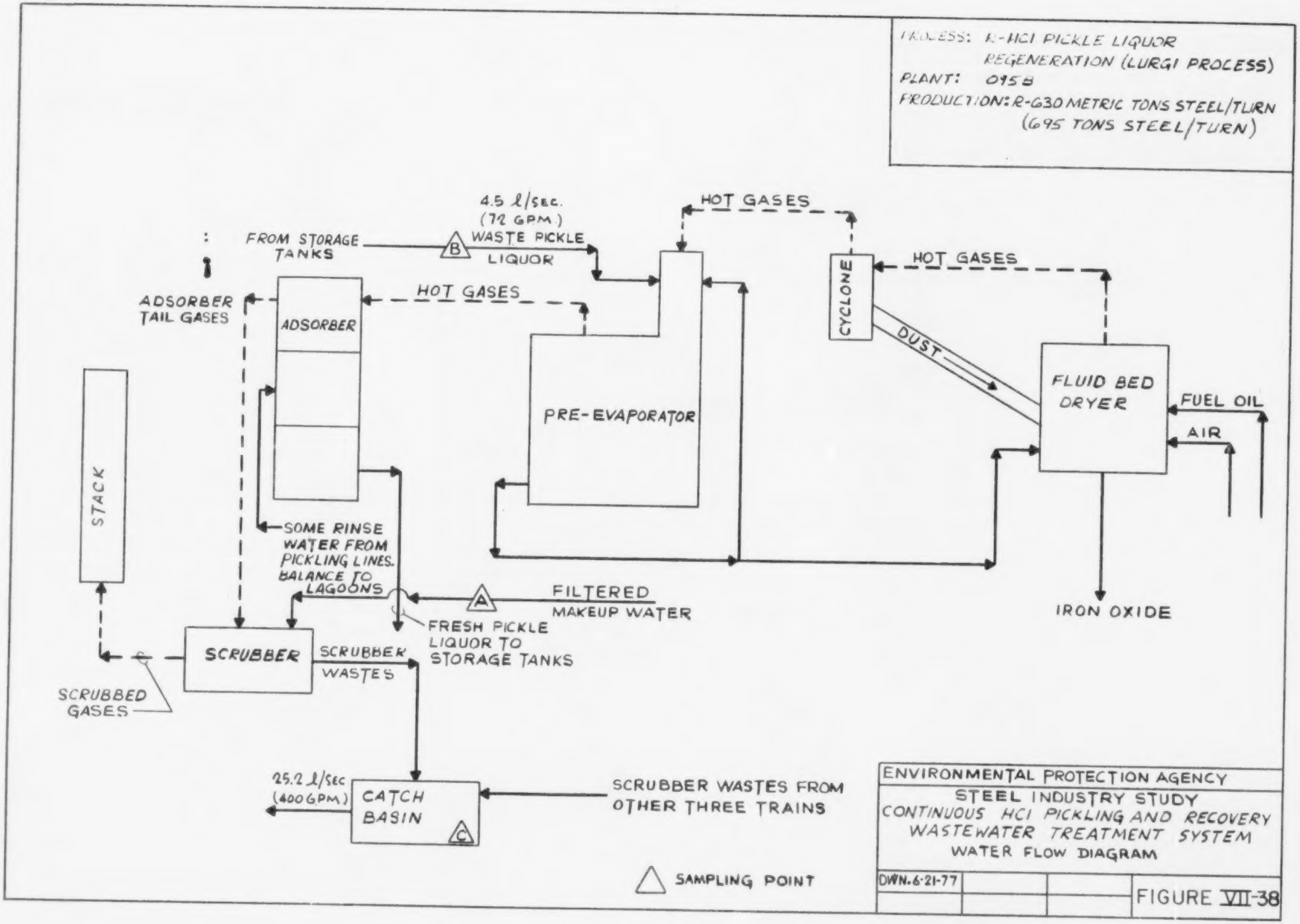


[illegible] CONTINUOUS HCl PICKLING-RINSES
PLANT: 095A
PRODUCTION: R-902 METRIC TONS STEEL/TURN
(995 TONS STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
CONTINUOUS HCl PICKLING - RINSES
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

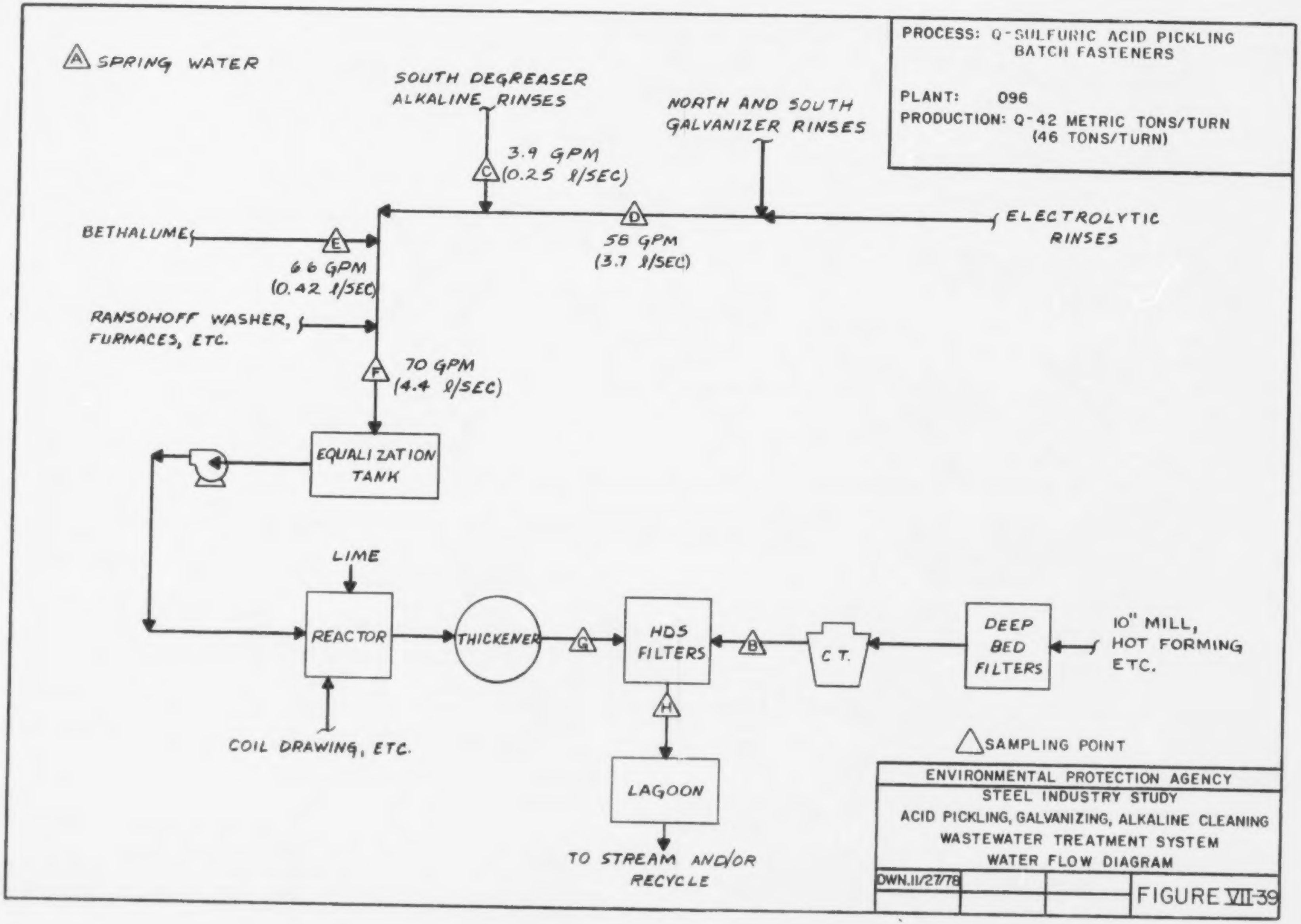
DWN: 6-21-77

FIGURE VII-37



PROCESS: R-HCl PICKLE LIQUOR REGENERATION (LURGI PROCESS)
PLANT: 095B
PRODUCTION: R-630 METRIC TONS STEEL/TURN (695 TONS STEEL/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
CONTINUOUS HCl PICKLING AND RECOVERY
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM
DWN. 6-21-77
FIGURE VII-38



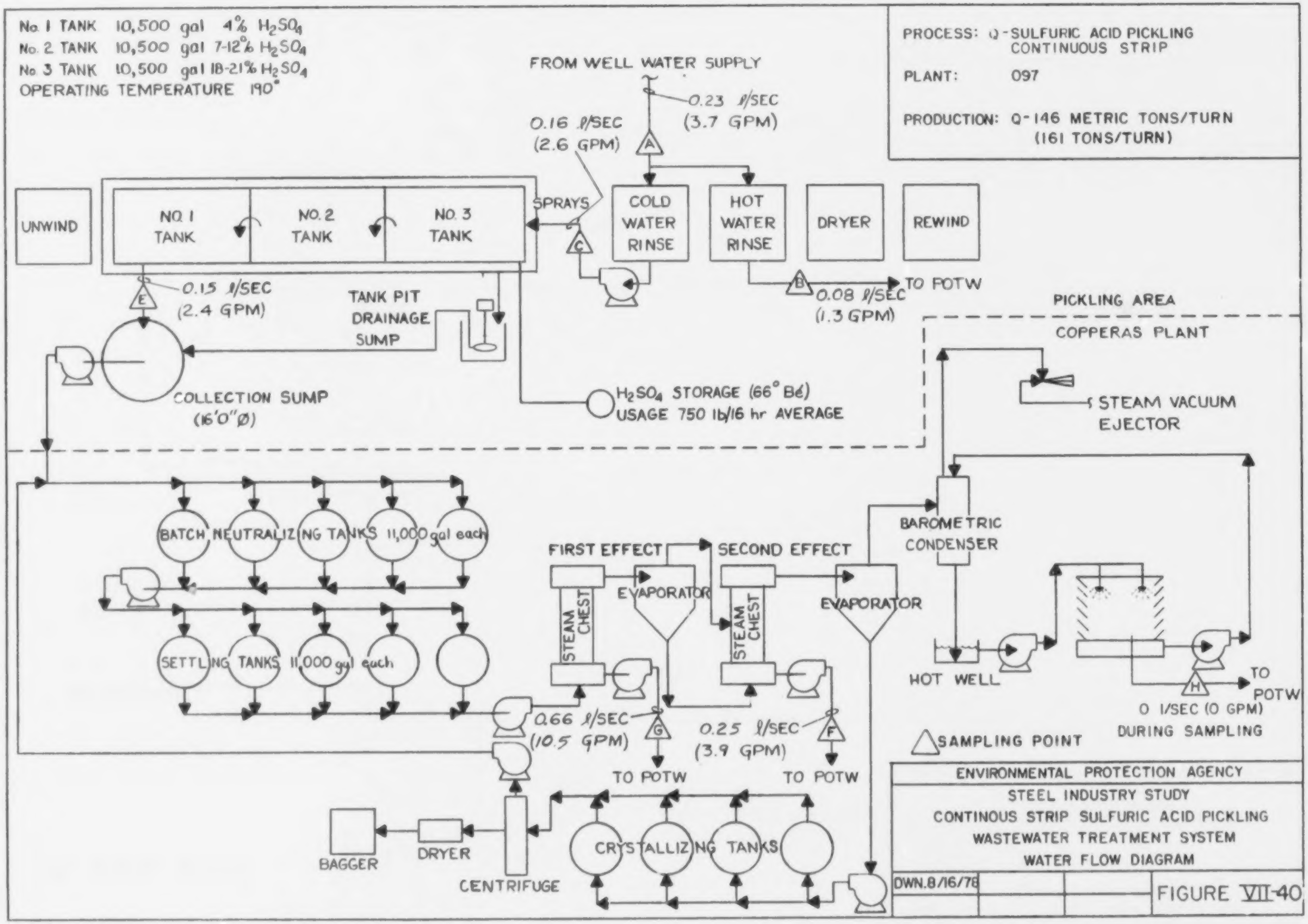
PROCESS: Q-SULFURIC ACID PICKLING
BATCH FASTENERS

PLANT: 096
PRODUCTION: Q-42 METRIC TONS/TURN
(46 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
ACID PICKLING, GALVANIZING, ALKALINE CLEANING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

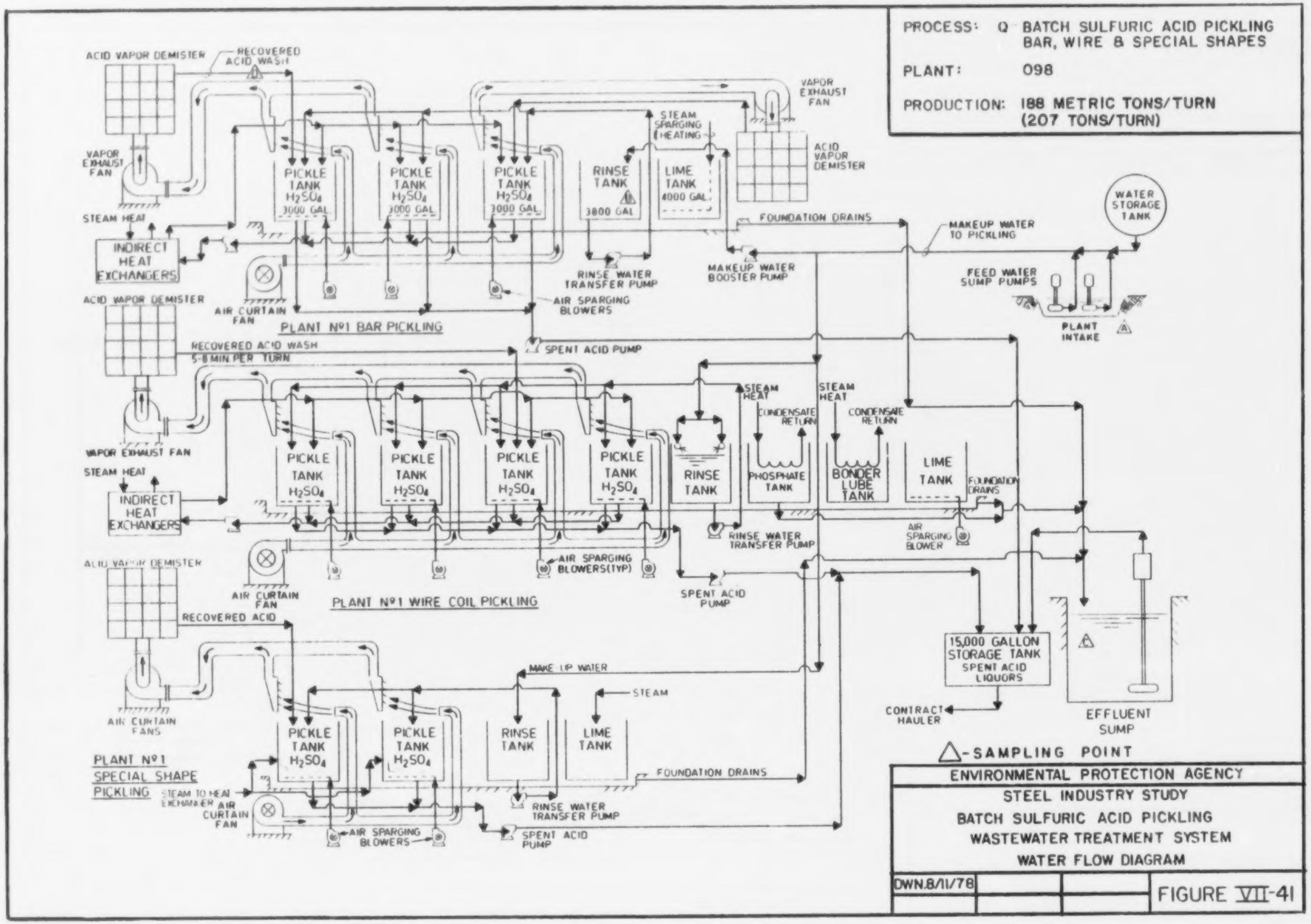
DWN. 11/27/78

FIGURE VII-39



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
CONTINOUS STRIP SULFURIC ACID PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-40



PROCESS: Q BATCH SULFURIC ACID PICKLING BAR, WIRE & SPECIAL SHAPES

PLANT: 098

PRODUCTION: 188 METRIC TONS/TURN (207 TONS/TURN)

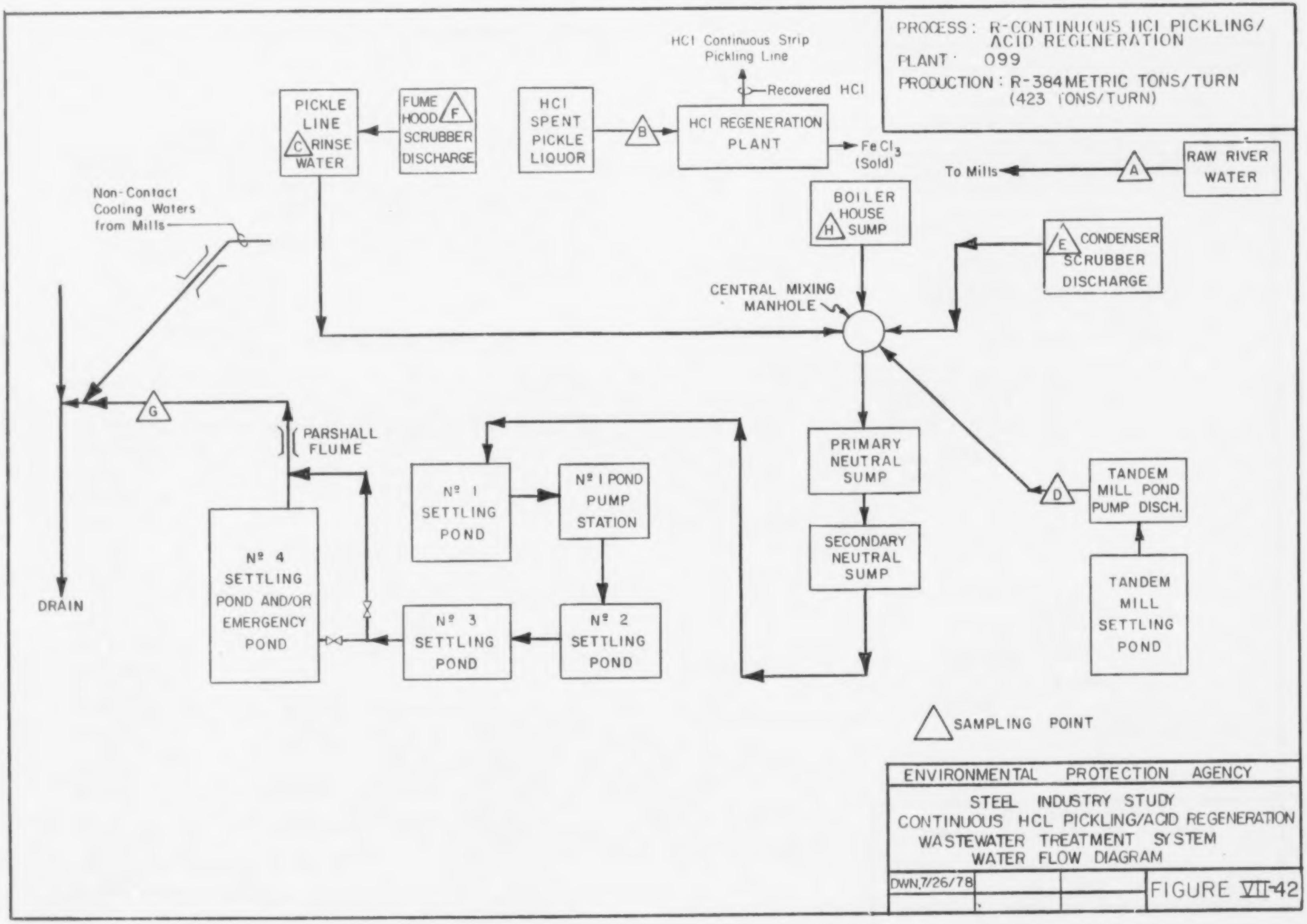
ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY

BATCH SULFURIC ACID PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWN.8/11/78

FIGURE VII-41

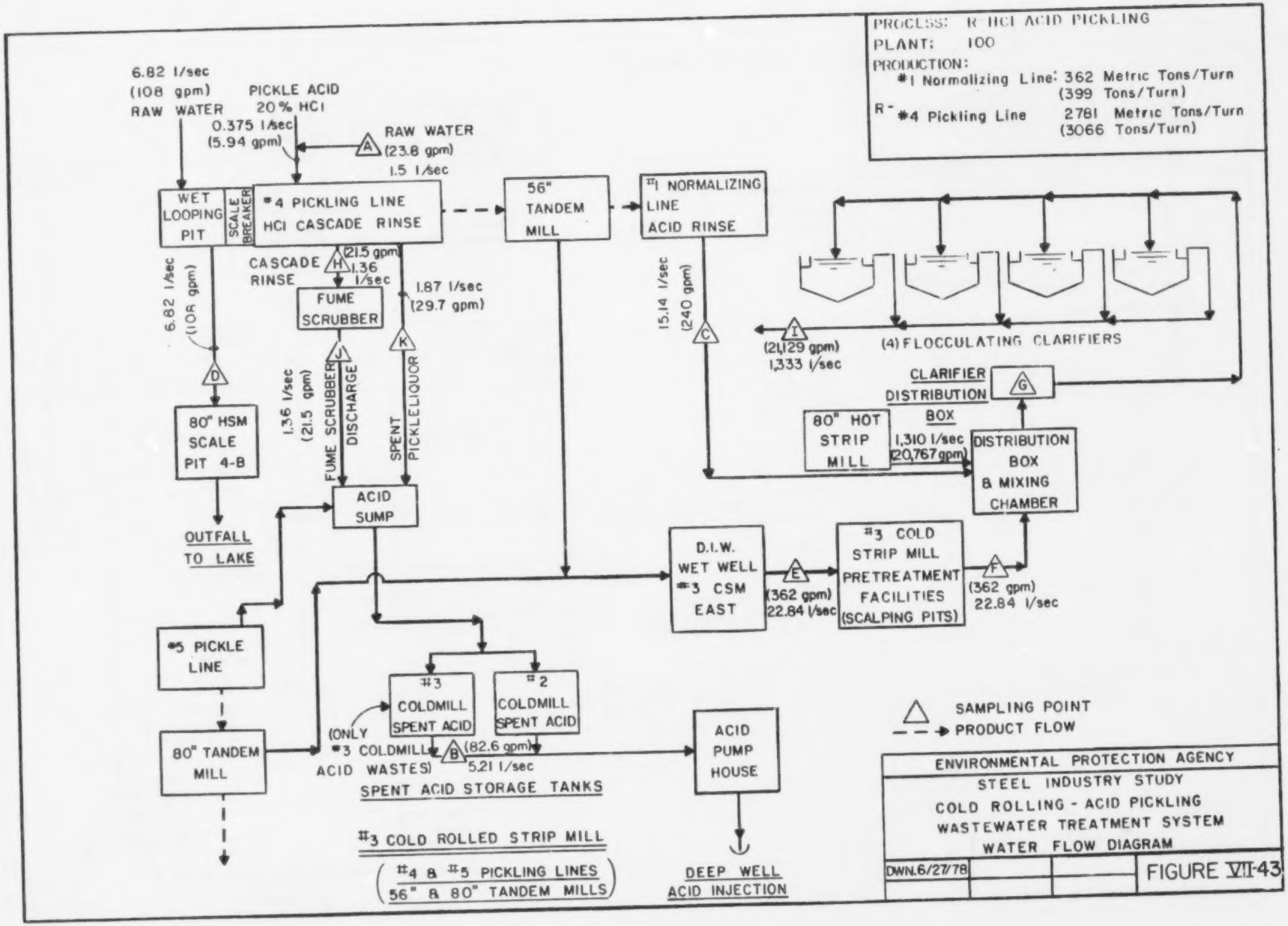


PROCESS: R-CONTINUOUS HCl PICKLING/ ACID REGENERATION
PLANT: 099
PRODUCTION: R-384 METRIC TONS/TURN (423 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
CONTINUOUS HCL PICKLING/ACID REGENERATION
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-42



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COLD ROLLING - ACID PICKLING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-43

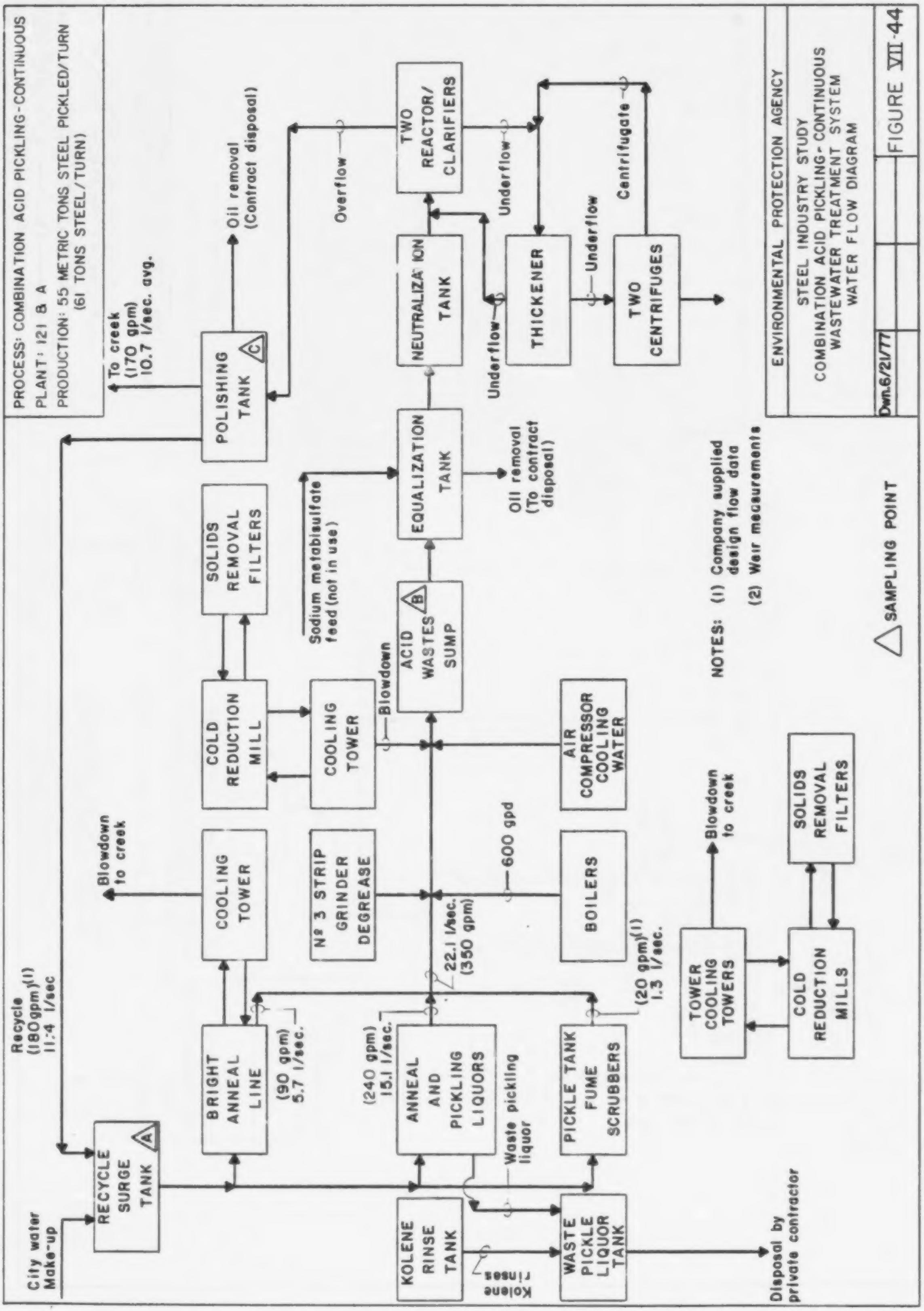
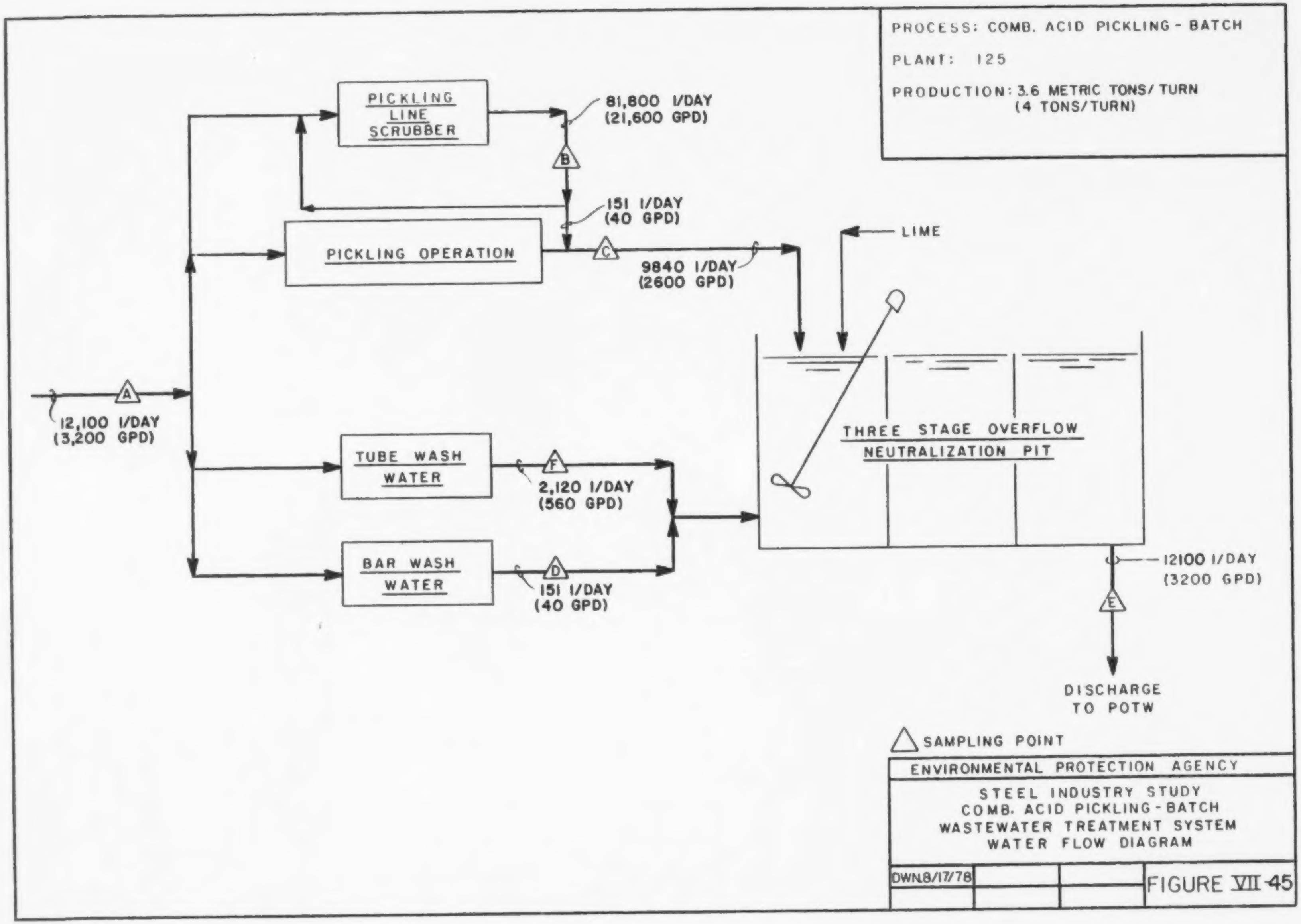


FIGURE VII-44



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMB. ACID PICKLING - BATCH
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-45

ACID PICKLING SUBCATEGORY

SECTION VIII

COST, ENERGY, AND NONWATER QUALITY IMPACTS

Introduction

This section addresses the cost, energy, and nonwater quality impacts of applying the different levels of pollution control to acid pickling operations. Topics of discussion include actual treatment costs incurred by plants sampled, the alternative treatment systems considered for use in the pickling subcategory, and the cost, energy, and other nonwater quality impacts associated with the application of the BPT, BAT, BCT, NSPS, and Pretreatment alternative treatment systems. In addition, the BCT cost comparison and the consumptive use of water are addressed.

Actual Costs Incurred by Plants Sampled for This Study

The water pollution control costs for the acid pickling operations sampled during this study are presented in Tables VIII-1 through VIII-12. The costs were derived from data supplied by the industry at the time of sampling or from data submitted in response to the D-DCPs. The costs have been adjusted to July 1978 dollars. Where central treatment systems are present, the industry often supplied total cost data for the entire treatment system. These costs were analyzed and apportioned to determine costs attributable to acid pickling wastes. In some instances, standard cost of capital and depreciation factors were applied to the reported costs to determine those portions of the annual costs of operation. In the remaining instances, those costs were provided by the plants.

Control and Treatment Technologies Recommended for Use in Acid Pickling

The treatment components and systems incorporated in the BPT and BAT alternative treatment systems are presented in Tables VIII-13 through VIII-16. The following items are described for each treatment step.

1. Treatment and/or control methods employed
2. Status and reliability
3. Problems and limitations
4. Implementation time
5. Land requirements
6. Environmental impacts other than water
7. Solid waste generation and primary constituents

It should be noted that the use of these control and treatment technology components will not be required by the final regulation. Any treatment system which achieves the proposed effluent limitations is adequate.

Cost, Energy, and Nonwater Quality Impacts

General Introduction

The Agency estimated cost and energy requirements on the basis of the alternative treatment systems developed in Sections IX through XIII of this report.

Estimated Costs for the Installation of Pollution Control Technologies

A. Costs Required to Achieve the Proposed BPT Limitations

The Agency has made estimates of the expenditures needed to bring acid pickling facilities from current treatment levels to a level from which BAT technology can be installed. This level is referred to as the "BAT Feed Level." These costs were considered as "BPT Required" costs for purposes of the economic impact analysis of the industry. To develop the costs required to achieve this level, a cost summary based upon a treatment model concept has been established. As explained above, this model concept recognizes the types of treatment systems presently installed and includes the types of components that the plants will install in the future.

In order to develop BPT compliance costs, it was necessary to develop BPT models sized to represent the average pickling plants in the United States. Separate model sizes were developed for batch and continuous operations in each acid pickling subdivision. The model sizes (tons/day) were developed on the bases of the average production capacities of each type of acid pickling operation. The components incorporated in the various treatment models are also representative of actual acid pickling operations.

Using the rationale explained above, a plant by plant inventory was conducted for each acid pickling segment to determine the number of plants in each model configuration. Using updated flow rates (see Section X) and the model sizes described previously, unit costs for each treatment component were developed. Total costs were then calculated by applying the treatment component model costs, adjusted for size, to each acid pickling site. BPT Capital Cost Tabulations are presented for all acid pickling lines in Tables VIII-27 through VIII-35 . The estimated capital costs of BPT technology in this subcategory are $309 million (July 1978 dollars). Of this total, equipment valued at $138.5 million is currently in place at various pickling facilities as of January 1978. The remaining $170.5 million remains to be expended for additional treatment equipment. The estimated annual operating costs for all acid pickling operations are approximately $68 million. Tables VIII-17 through VIII-26 present BPT model capital and annual costs and effluent flows and concentrations for each acid pickling subdivision. Table VIII-58 details the capital and operating costs at BPT for all segments of the acid pickling subcategory.

B. Costs Required to Achieve the BAT Limitations

The Agency considered three BAT alternative treatment systems for all acid pickling segments except for sulfuric acid recovery. These operations achieve zero discharge at BPT. Therefore, no additional treatment components are necessary at the BAT level. For all other segments of the acid pickling subcategory, BAT Alternative No. 1 consists of a cascade rinse system. BAT Alternative No. 2 adds sulfide precipitation and a filtration system to the BAT 1 component. BAT Alternative No. 3 achieves zero discharge through a cascade rinse system, evaporation, and 100% recycle. Additional details and rationale for these alternatives are provided in Section X. The additional capital and operating costs at BAT for operations in the various acid pickling segments appear in Tables VIII-36 through VIII-42. Table VIII-59 details the capital and operating costs for the three BAT alternatives for all segments of the acid pickling subcategory.

C. Costs Required to Achieve BCT Limitations

The BCT cost analyses for the various acid pickling segments are presented in Tables VIII-43 through VIII-46, while additional information regarding BCT is provided in Section XI.

D. Costs Required to Achieve NSPS

Two different NSPS alternatives are being considered for hydrochloric and combination acid pickling operations and one for sulfuric acid pickling. New facilities constructed after the proposal of this regulation will be required to meet NSPS. Model costs have been developed for the NSPS alternative treatment systems. These costs are shown in Tables VIII-47 through VIII-53 for pickling operations.

E. Costs Required to Achieve Pretreatment Standards

Pretreatment Standards apply to those existing (PSES) and new (PSNS) sources which continue or elect to discharge to POTW systems. Tables VIII-54 through VIII-57 present the costs of the pretreatment alternative systems developed for each segment of the acid pickling subcategory.

Energy Impacts

Moderate amounts of energy are required for the various levels of treatment in the acid pickling subcategory. Major energy expenditures for the subcategory occur at the BPT treatment level. BAT Alternatives No. 1 and 2 require little or no additional energy. However, BAT Alternative No. 3 is extremely energy intensive. The hydrochloric acid regeneration segment is the only one where BAT No. 3 energy costs are not greater than BPT energy costs. This is due to the acid regeneration system which requires additional energy. The sulfuric acid recovery models only incur energy costs at BPT, since the system achieves zero discharge at this level of treatment.

A. Energy Impacts at BPT

The estimated energy requirements are based upon the assumption that all acid pickling operations will install treatment systems similar to the alternative treatment systems which have flows similar to those of the models discussed in Section IX. On this basis, the estimated annual energy usage at the "BAT Feed Level" for all pickling operations is 423 million kilowatt hours of electricity. This estimate represents about 0.7 percent of the 57 billion kilowatt hours used by the steel industry in 1978. Refer to Table VIII-60 for a detailed analysis of the BPT energy requirements for the acid pickling segments.

B. Energy Impacts at BAT

The estimated energy requirements for the BAT treatment alternatives are based upon the same assumptions noted above for BPT. The estimated energy requirements needed to upgrade facilities to the three BAT alternatives appear in Table VIII-60 for the segments of the acid pickling subcategory.

C. Energy Impacts at BCT

The estimated energy requirements for the BCT level of treatment in the acid pickling subcategory appear in Table VIII-60.

D. Energy Impacts at NSPS, PSES, and PSNS

The energy requirements for the NSPS, PSES, and PSNS treatment models appear in Table VIII-60. Only model-based estimates are presented for NSPS and PSNS as estimates of future additions of capacity were not made as part of this study. The energy consumption associated with PSES is included in the totals for BPT and BAT.

Nonwater Quality Impacts

In general, there are minimal nonwater quality impacts associated with the alternative treatment systems. Air pollution, solid waste disposal, and water consumption impacts were considered.

A. Air Pollution

Sulfide addition is incorporated in the BAT, NSPS, PSES alternative treatment systems and PSNS Alternative No. 2. In the event of treatment process control upsets, the atmospheric discharge of sulfides could occur. However, the use of FeS rather than H_2S is recommended to avoid this problem. No other air pollution impacts will result from the installation of any of the treatment components considered. Sulfide addition is not the selected alternative.

B. Solid Waste Disposal

Considerable amounts of solid wastes will be generated at the BPT level of treatment, consisting primarily of metal hydroxide sludges that result from the lime neutralization step. Very little additional sludge will be generated as a result of installation of the BAT components. The amounts of dry solids that can be expected for operations in the various pickling segments appear in Table VIII-61.

C. Water Consumption

The Agency does not expect that a significant amount of water will be consumed as a result of the installation of BPT technology in the acid pickling subcategory. The model treatment system includes recycle for fume scrubber streams. Some water may be consumed in these systems; however, the amount is expected to be minimal. No cooling devices are envisioned for these recycle systems, so evaporation will not be a problem. Hence, no significant water consumption is expected for this subcategory at the BPT level. No appreciable amounts of water are expected to be consumed at any other treatment level in the acid pickling subcategory.

Summary of Impacts

In summary, the Agency concludes that the pollutant reduction benefits described below for the acid pickling subcategory justify any adverse energy and nonwater quality environmental impacts.

	Effluent Discharges (Tons/Year)		
Pollutant	Raw Waste	Proposed BPT	Proposed BAT
Flow (MGD)	172.7	69.2	15.0
TSS	36,211	3,819	551
Oil & Grease	5,003	850	141
Fluoride	29,345	257	80.8
Toxic Metals	31,918	86.1	15.5
Toxic Organics	4.6	1.7	0.3
Dissolved Iron	544,989	85.0	18.3

NOTE: PSES discharges are included in those for BPT and BAT.

TABLE VIII-1

EFFLUENT TREATMENT COST
SULFURIC ACID PICKLING - BATCH SPENT CONCENTRATES

(All costs are expressed in July 1978 dollars)

Plant Code Reference No	I-2 0856P	O-2 0590	P-2 0312	Q-2 0894	R-2 0240B	R 0240A
Initial Investment	1,203,800	413,800	322,490	512,960	469,360	280,000
Annual Cost						
Cost of Capital	51,760	17,790	13,870	22,060	20,180	12,040
Depreciation	120,380	41,380	32,250	51,300	46,940	28,000
Operation & maintenance	49,910	2,320	-	19,910	27,820	-
Energy and Power	25,710	-	101,730	24,880	61,030	59,660
Other	484,000	-39,230	-34,170	-102,110	35,120	-
TOTAL	731,760	22,260	113,680	16,040	191,090	99,700
$/Ton	2.81	0.56	3.11	0.51	0.58	0.38

Plant Code Reference No	090 0476A	091 0612	096 0112I	098 0684D
Initial Investment	448,550	394,800	817,600	NR
AnnualCost				Hauling
Cost of Capital	19,290	16,980	35,160	costs
Depreciation	44,860	39,480	81,760	estimated
Operation & Maintenance	34,940	34,380	34,230	at
Energy and Power	6,860	22,800	2,900	210,000/yr
Other	-11,830	3,600	3,730	-
TOTAL	94,120	106,440	157,780	210,000
$/Ton	4.92	0.52	17.46	1.41

NR: No response

TABLE VIII-2

EFFLUENT TREATMENT COST
SULFURIC ACID PICKLING-BATCH RINSEWATER

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	I-2 (1) 0856P	I-2 (2) 0856P	R-2 0240B	S-2 0256G
Initial Investment	83,920	209,800	64,000	16,730
Annual Cost				
Cost of Capital	3,610	9,020	2,750	720
Depreciation	8,390	20,980	6,400	1,670
Operation and Maintenance	820	2,060	3,790	4,380
Energy and Power	10	30	8,320	3,100
Other	780	1,990	4,790	90,060
TOTAL	13,610	34,080	26,050	99,930
$/Ton	0.19	0.18	0.079	1.06

Plant Code Reference No	R 0240A	090 0476A	091 0612	096 0112I
Initial Investment	144,240	178,080	794,540	-
Annual Cost				
Cost of Capital	6,200	7,660	34,179	70,700
Depreciation	14,420	17,810	79,450	164,410
Operation and Maintenance	-	7,420	69,200	68,450
Energy and Power	29,830	5,380	45,890	5,800
Other	-	1,160	7,250	7,450
TOTAL	50,450	39,410	235,960	316,810
$/Ton	0.19	2.06	1.15	35.06

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(1) Spray rinse
(2) Cascade rinse

TABLE VIII-3

EFFLUENT TREATMENT COST
SULFURIC ACID PICKLING - CONTINUOUS SPENT CONCENTRATES

(All costs are expressed in July 1978 dollars)

Plant Code Reference No	H-2 0432A	T-2 0792B	QQ-2 0584E	TT-2 0856D	WW-2 0868A
Initial Investment	Hauling	679,000	1,534,500	3,017,400	3,650,000
Annual Cost	costs				
Cost of Capital	estimated at	29,200	65,980	129,750	156,950
Depreciation	$264,000/yr	67,900	153,450	301,750	365,000
Operation & Maintenance		-	65,940	464,050	313,260
Energy and Power		30,350	12,410	888,840	4,000
Other		-31,930	28,860	767,320	1,677,630
TOTAL	264,000	95,520	326,640	2,551,700	1,677,630
$/Ton	0.43	1.41	0.23	1.53	1.63

TABLE VIII-4

EFFLUENT TREATMENT COST
SULFURIC ACID PICKLING-CONTINUOUS RINSEWATER

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	H-2 0432A	QQ-2 0584E	SS-2 0112A	WW-2 0868A
Initial Investment	297,630	2,087,240	144,450	716,170
Annual Cost				
Cost of Capital	12,800	89,750	6,210	30,800
Depreciation	29,760	208,720	14,450	71,620
Operation and Maintenance	14,940	163,160	13,570	55,990
Energy and Power	9,370	154,300	10,790	7,670
Other	1,530	-	3,290	34,460
TOTAL	68,400	615,930	48,310	200,540
$/Ton	0.11	0.43	0.078	0.29

TABLE VIII-5

EFFLUENT TREATMENT COST
SULFURIC ACID PICKLING-CONTINUOUS FUME HOOD SCRUBBERS

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	QQ-2 0584E	SS-2 0112A	WW-2 0868A
Initial Investment	25,350	14,310	71,620
Annual Cost			
Cost of Capital	1,090	615	3,080
Depreciation	2,540	1,430	7,160
Operation and Maintenance	1,980	1,350	5,600
Energy and Power	1,710	1,070	770
Other	-	330	3,450
TOTAL	7,320	4,795	20,060
$/Ton	0.0052	0.0078	0.029

TABLE VIII-6

EFFLUENT TREATMENT COST
SULFURIC ACID PICKLING-BATCH AND CONTINUOUS ACID RECOVERY PLANT WASTEWATER

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	090 0476A
Initial Investment	1,630
Annual Cost	
Cost of Capital	70
Depreciation	160
Operation and Maintenance	70
Energy and Power	50
Other	10
TOTAL	360
$/Ton	0.019

TABLE VIII-7

EFFLUENT TREATMENT COST
HYDROCHLORIC ACID PICKLING-BATCH SPENT CONCENTRATES

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	U-2 0480A	V-2 0936
Initial Investment	-	-
Annual Cost		
Cost of Capital	-	-
Depreciation	-	-
Operation and Maintenance	-	-
Energy and Power	-	-
Other	5860	7848
TOTAL	5860	7848
$/Ton	0.675	0.112

TABLE VIII-8

EFFLUENT TREATMENT COST
HYDROCHLORIC ACID PICKLING-BATCH RINSEWATER

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	U-2 0480A	V-2 0936
Initial Investment	-	-
Annual Cost		
Cost of Capital	-	-
Depreciation	-	-
Operation and Maintenance	-	2180
Energy and Power	-	-
Other	27311	1591
TOTAL	27311	3771
$/Ton	3.143	0.054

TABLE VIII-9

EFFLUENT TREATMENT COST
HYDROCHLORIC ACID PICKLING-CONTINUOUS SPENT CONCENTRATES

(All costs are expressed in July 1978)

Plant Code Reference No.	X-2 0060B	Z-2 0396D	BB-2 0060	091 0612
Initial Investment	2,928,397	1,645,754	1,717,169	56,101
Annual Cost				
Cost of Capital	122,992	69,122	72,120	2,412
Depreciation	292,840	164,576	171,718	5,610
Operation and Maintenance	-	-	101,850	4,470
Energy and Power	387,555	679,595	33,333	1,936
Other	-1,397,605	-	-	-
TOTAL	-594,217	913,292	379,021	14,428
$/Ton	-1.046	2.021	0.166	0.164

Plant Code Reference No	093 0396A	095 0584F	099(1) 0528B
Initial Investment	1,645,754	10,632,692	44,090
Annual Cost			
Cost of Capital	69,122	1,249,341	1,896
Depreciation	164,576	106,327	4,409
Operation and Maintenance	-	1,357,196	9,952
Energy and Power	679,595	958,643	-24
Other	-	349,193	437
TOTAL	913,292	4,020,700	16,670
$/Ton	2.021	-	0.030

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(1) Includes only the costs of treating fume hood scrubbers.

TABLE VIII-10

EFFLUENT TREATMENT COST
HYDROCHLORIC ACID PICKLING - CONTINUOUS RINSEWATER

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	I-2 0856P	Z-2 0396D	AA-2(1) 0384A	BB-2 0060	091 0612	093 0396D	099 0528B
Initial Investment	14,951	86,619	394,950	5,647,341	399,528	86,619	815,271
Annual Cost							
Cost of Capital	628	3,638	16,589	237,189	39,953	8,661	81,527
Depreciation	1,495	8,661	39,495	564,733	19,300	-	21,493
Operation & Maintenance	145	-	120,966	366,104	13,786	35,768	-455
Energy and Power	-	35,768	4,543	304,612	12,532	-	162,543
Other	143	-	-	-	17,180	3,638	35,057
TOTAL	2,411	48,067	181,593	1,442,638	102,751	48,067	308,236
$/Ton	0.560	0.106	0.215	0.633	1.166	0.106	0.556

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(1) Applies to plant 100 in toxic pollutant study.

TABLE VIII-11

EFFLUENT TREATMENT COST
COMBINATION ACID PICKLING-BATCH OPERATIONS

(All costs are expressed in July 1978 dollars)

Plant Code Refereuce No.	U 0060D	C 0424	F 0856H	L 0440A	124 0088D	125 0884E	** 112H(1)
Initial Investment	169,387	140,462	508,760	None	40,574	18,310	283,611
Annual Cost							
Cost of Capital	7,284	6,077	21,877	-	1,745	787	12,195
Depreciation	16,938	14,135	50,876	-	4,057	1,831	28,361
Operation and Maintenance(2)	11,613	4,081	33	21,014	20,830	11,279	24,711
Energy and Power(2)	-	-	-	-	-	-	-
Other	-	1,006	9,335	5,088	-	-	-
TOTAL	35,836	33,042	82,140	26,102	26,632	13,897	65,267
$/Ton	19.91	0.95	4.69	0.83	6.40	2.89	1.22

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(1): Cost data was received in the response to the detailed questionnaire.
(2): Energy and power costs are included in operation and maintenance.
** : No plant code assigned.

TABLE VIII-12

EFFLUENT TREATMENT COST
COMBINATION ACID PICKLING-CONTINUOUS OPERATIONS

(All costs are expressed in July 1978 dollars)

Plant Code Reference No.	D 0248 A & B	I 0432K	O 0176	121 0900
Initial Investment	-	546,051	674,735	1,100,683
Annual Cost				
Cost of Capital	-	23,259	29,014	47,329
Depreciation	-	54,605	67,474	110,068
Operation & Maintenance (1)	-	17,696	39,741	49,986
Energy and Power (1)	-	-	-	-
Other	-	90,692	49,686	29,212
TOTAL	-	186,474	187,974	239,265
$/Ton	0.35	0.54	3.68	2.56

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(1) Energy & power costs are included in operation and maintenance

TABLE VIII-13

CONTROL AND TREATMENT TECHNOLOGIES ACID PICKLING SUBCATEGORY

Sulfuric Acid - Batch and Continuous Acid Recovery

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Spent acid storage	Widely practiced.	None if storage tank is constructed properly.	6 months	20' x 20'	None	None
B. Acid recovery system	Excellent, yielding no aqueous discharge. Currently in use at several pickling plants.	High initial capital cost is eventually balanced by recovery of usable products. High energy requirement.	24 months	200'x200'	Ferrous sulfate heptahydrate is highly soluble so it cannot be landfilled.	Generates large amounts of $FeSO_4 \cdot 7H_2O$ crystals.

TABLE VIII-14

CONTROL AND TREATMENT TECHNOLOGIES
ACID PICKLING SUBCATEGORY

Sulfuric Acid - Batch and Continuous Neutralization

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Spent acid equalization	Widely practiced.	None if storage tank is constructed properly.	6 months	20' x 20'	None	None
B. FHS recycle blowdown goes to further treatment.	Practiced at many operations in the subcategory.	Requires sufficient blowdown to reduce possibility of dissolved solids build up and plugging.	2 months	25' x 25'	None	None
C. Equalization	Practiced at many operations. Oil separator not needed unless cold mill wastes are jointly treated.	Basin must be sized sufficiently to accommodate batch dump and other irregular flows.	3 months	50'x50'	None	Any oils collected must be landfilled or incinerated.
D. Neutralization with lime to raise pH to 6-9.	Practiced at a majority of operations.	Increased chemical cost. Considerable amounts of solids are generated which must be recovered.	3 months	50'x50'	See solid waste impacts.	Lime addition increases the amount of sludge which must be landfilled.
E. Flocculation with polymer to aid flocculation.	Widely practiced.	Increased chemical costs.	6 months	25'x25'	None	No significant amount of sludge generated.
F. Aeration	Reliable when attention is given to operation and maintenance.	High capital costs. Sludges hard to dewater.	9-12 months	200' x 200'	Potential for fume generation	Increased metallic precipitates.
G. Settling Basin (last step of BPT).	Practiced at many operations in the subcategory.	Accumulated solids must be periodically removed.	6 months	-	Accumulated solids must be disposed of properly.	Sludges must be landfilled.

TABLE VIII-14
CONTROL AND TREATMENT TECHNOLOGIES
ACID PICKLING SUBCATEGORY
PAGE 2

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
BAT Alternatives						
H. Cascade rinse system to reduce rinsewater discharge (end of BAT Alternative 1).	Practiced at numerous operations in other subcategories.	Requires coordination with rinsewater flow ratios.	6-12 months	50'x100'	None	None
I. To H, add sulfide precipitation to form metallic precipitates.	Used in various industrial wastewater treatment operations for toxic metal removal.	Care must be exercised in the handling of the feed solution. The treatment process control is required to prevent odor problems.	6 months	20'x20'	Precipitates need proper disposal. Sulfide odors can result from improper control.	Precipitates must be filtered.
J. Filtration of overflow (end of BAT Alternative 2)	Practiced at numerous operations.	Hydraulic overloads must be controlled.	15-18 months	25' x 25'	Backwash solids must be properly disposed.	The backwash solids are removed by vacuum filtration.
K. To H, add an evaporation system.	Demonstrated in the power generation industry.	Needs maintenance. Economics depend on integration of this system into the water cycle.	6 months	60'x60'	Uses approximately 90 kwh/100 gallons of feedwater.	Slurry generated must be dewatered. Sludge generated is decreased.
L. Recycle distillate quality effluent back to process (end of BAT Alternative 3).	Demonstrated in the power generation industry.	None	2 months	25'x25'	None	None

TABLE VIII-15

CONTROL AND TREATMENT TECHNOLOGIES
ACID PICKLING SUBCATEGORY

Hydrochloric Acid - Batch and Continuous

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Spent acid storage	Practiced at many operations in the subcategory.	None, if storage tank is constructed properly.	6 months	20' x 20'	None	None
B. Install acid regeneration system (this step is applicable only to continuous acid regeneration process).	Good with proper attention to operation.	Requires coordination.	6-12 months	200'x400'	Energy intensive	Sludges must be disposed of in a landfill.
C. FHS Recycle - blowdown goes to futher treatment.	Practiced at many operations in the subcategory.	Requires sufficient blowdown to reduce possibility of dissolved solids buildup and plugging.	2 months	25'x25'	None	None
D. Equalization	Practiced at many operations in the subcategory.	Equalization basin must be sufficiently large to accommodate batch dump or other irregular flow.	3 months	50'x50'	None	If any oils are collected, they must be incinerated or landfilled.
E. Add lime to raise the pH to 6-9 in mixing tank.	Practiced at a majority of operations in this subcategory.	Increased chemical costs. Considerable amounts of solids are generated which must be treated.	3 months	50'x50'	See solid waste impacts.	Addition of lime increases amount of sludges generated Sludges must be landfilled.

TABLE VIII-15
CONTROL AND TREATMENT TECHNOLOGIES
ACID PICKLING SUBCATEGORY
PAGE 2

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
F. Polymer addition to aid flocculation.	Widely practiced. Reliable method of promoting settling.	Increased chemical costs.	6 months	20'x20'	None	No significant amounts generated.
G. Aeration	Good when given attention to operation and maintenance.	High capital costs. Sludges hard to dewater.	9-12 months	200'x200'	Potential for fume generation.	Increased metallic precipitates.
H. Thickener	Practiced by many operations.	Needs considerable maintenance.	6 months	150'x125'	Produces sludge.	Sludges must be landfilled.
I. Vacuum Filter to thickener underflow (last step in BPT).	Practiced at many operations.	Increased capital and operating costs.	15-18 months	25'x25'	Dewatered sludge requires disposal.	Solids produced must be landfilled.
BAT Alternatives						
J. Cascade rinse system to reduce rinsewater discharge (end of BAT Alternative 1).	Practiced at numerous operations.	Requires coordination with rinsewater flow ratios.	6-12 months	50'x100'	None	None
K. To J, add sulfide precipitation system.	Used in various industry treatment opertions for purpose of toxic metals removal.	Care is to be exercised in handling of feed solution. Careful treatment process control required to prevent odor problems.	6 months	20'x20'	Precipitates requires proper disposal. Odors can result if treatment process is not controlled.	Precipitates must be filtered.
L. Filtration of overflow (end of BAT Alternative 2).	Practiced at numerous operations	Hydraulic overloads must be controlled.	15-18 months	25' x 25'	Backwash solids must be properly disposed.	Backwash solids are removed by vacuum filtration.
M. To J, install vapor compression/evaporation system.	Demonstrated in power generation industry.	Needs maintenance. Economics dependent on integration of this system into water cycle.	6 months	60'x60'	Uses approximately 90 kwh/1000 gallons of feedwater.	Slurry generated must be dewatered.

TABLE VIII-15
CONTROL AND TREATMENT TECHNOLOGIES
ACID PICKLING SUBCATEGORY
PAGE 3

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
N. Recycle distillate to process (end of BAT Alternative 3).	Widely practiced in the power generation industry.	None	12-14 months	25'x25'	None	None

TABLE VIII-16

CONTROL AND TREATMENT TECHNOLOGIES
ACID PICKLING SUBCATEGORY

Combination Acid - Batch and Continuous

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Recycle FMS wastewater with a blowdown going to further treatment.	Practiced at many of the operations in the subcategory.	Requires sufficient blowdown to reduce to possibility of dissolved solids buildup and plugging.	2 months	25'x25'	None	None
B. Equalization with oil separation.	Practiced at many operations. Oil separator not needed unless cold mill wastes are jointly treated.	Basin must be sized sufficiently large to accommodate batch dump and other irregular flows.	3 months	50'x50'	None	Any oils collected must be landfilled or incinerated.
C. Neutralization with lime to raise pH to 6-9.	Practiced at a majority of operations.	Increased chemical cost. Considerable amounts of solids are generated which must be treated.	3 months	50'x50'	See solid waste impacts.	Lime addition increases the amount of sludge which must be landfilled.
D. Flocculation with polymer to aid flocculations.	Widely practiced.	Increased chemical costs.	6 months	25'x25'	None	No significant amount of sludges generated.
E. Clarifier	Practiced at many operations.	Need considerable maintenance.	6 months	150'x125'	Produces sludge.	Sludges must be landfilled.
F. Vacuum Filtration of clarifier underflow (last step of BPT).	Practiced at many operations.	Increased capital and operating costs.	6 months	25'x25'	Dewatered sludge will require disposal.	Solids must be disposed via landfill.
BAT Alternatives						
G. Cascade rinse system to reduce rinsewater discharge (end of BAT Alterntive 1).	Practiced at numerous operations in other subcategories.	Requires coordination with rinsewater flow ratios.	6-12 months	50'x100'	None	None

TABLE VIII-16
CONTROL AND TREATMENT TECHNOLOGIES
ACID PICKLING SUBCATEGORY
PAGE 2

Treatment and/or Control Methods Employed	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
H. To G, add sulfide precipitation to form metallic precipitates.	Used in various industrial wastewater treatment operations for toxic metal removal.	Care must be exercized in the handling of the feed solution. The treatment process control is required to prevent odor problem.	6 months	20'x20'	Precipitates need proper disposal. Sulfide odors can result from improper control.	Precipitates must be filtered.
I. Filtration of overflow (end of BAT Alternative 2).	Practiced at numerous operations.	Hydraulic overloads must be controlled.	15-18 months	25' x 25'	Backwash solids must be properly disposed.	The backwash solids are removed by vacum filtration.
J. To G, install vapor compression/evaporation system.	Demonstrated in the power generation industry.	Needs maintenance. Economics depend on integration of this system in the water cycle.	6 months	60'x60'	Uses approximately 90 kwh/ 1000 gallons of feedwater.	Slurry generated must be dewatered. Sludge generated is decreased.
K. Recycle distillate quality effluent back to process (end of BAT Alternate 3).	Widely practiced in the power generation industry.	None	2 months	25'x25'	None	None

TABLE VIII-17

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling-Sulfuric Acid	Model: Size-TPD:	500
:	Batch	Oper. Days/Year :	260
:	Neutralization	Turns/Day :	3

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	119	128	381	99	60	787
Annual Cost $ x 10^{-3}						
Capital	5.1	5.5	16.4	4.3	2.6	33.8
Depreciation	11.9	12.8	38.1	9.9	6.0	78.7
Operation & Maintenance	4.2	4.5	13.3	3.5	2.1	27.5
Sludge Disposal	-	-	-	-	3.4	3.4
Energy & Power(1)	-	0.9(2)	6.8	0.4	-	7.2
Chemical Costs	-	1.2	19.3	3.8	-	24.3
TOTAL	21.2	24.0(2)	93.9	21.9	13.8	174.9

	Effluent Quality(3)	BPT Effluent Level
	Flow, gal/ton	360
	Total Suspended Solids	50
	Oil and Grease	10
	Dissolved Iron	1.0
	pH, Units	6-9
115	Arsenic	0.10
118	Cadmium	0.10
119	Chromium	0.10
120	Copper	0.10
122	Lead	0.10
124	Nickel	0.20
128	Zinc	0.10

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(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Spent Acid Equalization
B: FHS Recycle
C: Equalization and Lime Addition
D: Polymer Addition, Aeration
E: Setting Basin

TABLE VIII-18

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Sulfuric Acid
: Batch
: Acid Recovery
: Carbon & Specialty

Model: Size-TPD: 500
Oper. Days/Year : 260
Turns/Day : 3

C&TT Step	A	B	Total
Investment $ x 10^{-3}	119	3430	3549
Annual Cost $ x 10^{-3}			
Capital	5.1	147.5	152.6
Depreciation	11.9	343.0	354.9
Operation & Maintenance	4.2	120.1	124.2
Crystal Disposal	-	56.2	56.2
Energy & Power	-	114.3	114.3
TOTAL	21.2	781.1	802.3
Less Credit(1)	-	45.5	45.5
Net Total	21.2	735.6	756.8

Effluent Quality(2)	BPT Effluent Level
Flow, gal/ton	0
Total Suspended Solids	-
Oil and Grease	-
Dissolved Iron	-
pH, Units	-
115 Arsenic	-
118 Cadmium	-
119 Chromium	-
120 Copper	-
122 Lead	-
124 Nickel	-
128 Zinc	-

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(1) Credit for acid recovery.
(2) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Spent Acid Storage System
B: Acid Recovery System

TABLE VIII-19

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Sulfuric Acid
: Continuous
: Neutralization
: Carbon & Specialty

Model: Size-TPD: 1980
Oper. Days/Year : 260
Turns/Day : 3

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	228	171	757	149	116	1421
Annual Cost $ x 10^{-3}						
Capital	9.8	7.3	32.5	6.4	5.0	61.0
Depreciation	22.8	17.1	75.7	14.9	11.6	142.1
Operation & Maintenance	8.0	6.0	26.5	5.2	4.1	49.8
Sludge Disposal	-	-	-	-	15.5	15.5
Energy & Power(1)	-	2.4(2)	19.2	0.5	-	19.7
Chemical Costs	-	2.0	97.8	9.8	-	109.6
TOTAL	40.6	32.4(2)	251.7	36.8	36.2	397.7

Effluent Quality(3)	BPT Effluent Level
Flow, gal/ton	250
Total Suspended Solids	50
Oil and Grease	10
Dissolved Iron	1.0
pH, Units	6-9
115 Arsenic	0.10
118 Cadmium	0.10
119 Chromium	0.10
120 Copper	0.10
122 Lead	0.10
124 Nickel	0.20
128 Zinc	0.10

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(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Spent Acid Equalization
B: FHS Recycle
C: Equalization and Lime Addition
D: Polymer Addition, Aeration
E: Setting Basin

TABLE VIII-20

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling-Sulfuric Acid	Model: Size-TPD:	1980
:	Continuous	Oper. Days/Year :	260
:	Acid Recovery	Turns/Day :	3
:	Carbon & Specialty		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	264	4034	4298
Annual Cost $ x 10^{-3}			
Capital	11.3	173.5	184.8
Depreciation	26.4	403.4	429.8
Operation & Maintenance	9.2	141.2	150.4
Crystal Disposal	-	128.7	128.7
Energy & Power	-	123.8	123.8
TOTAL	46.9	970.6	1017.5
Less Credits(1)	-	260.6	260.6
Net Total	46.9	710.0	756.9

Effluent Quality(2)	BPT Effluent Level
Flow, gal/ton	0
Total Suspended Solids	-
Oil and Grease	-
Dissolved Iron	-
pH, Units	-
115 Arsenic	-
118 Cadmium	-
119 Chromium	-
120 Copper	-
122 Lead	-
124 Nickel	-
128 Zinc	-

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(1) Credit for acid recovery.
(2) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Spent Acid Storage System
B: Acid Recovery System

TABLE VIII-21

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Hydrochloric Acid
: Batch-Neutralization
: Carbon & Specialty

Model Size-TPD : 190
Oper. Days/Year: 260
Turns/Day : 2

C&TT Step	A	B	C	D	E	F	G(3)	H(3)	Total
Investment $ x 10^{-3}	55	76	186	47	26	51	123	138	702
Annual Cost $ x 10^{-3}									
Capital	2.4	3.3	8.0	2.0	1.1	2.2	5.3	5.9	30.2
Depreciation	5.5	7.6	18.6	4.7	2.6	5.1	12.3	13.8	70.2
Operation & Maintenance	1.9	2.7	6.5	1.6	0.9	1.8	4.3	4.8	24.6
Sludge Disposal	-	-	-	-	-	-	-	7.6	7.6
Energy & Power	-	0.6(2)	1.9	0.3	0.2	0.5	0.1	1.3	4.5
Chemical Costs	-	-	-	11.0	2.1	-	-	-	13.1
TOTAL	9.8	13.6(2)	35.0	19.6	6.9	9.6	22.2	33.4	150.2

	Effluent Quality(4)	BPT Effluent Level
	Flow, gal/ton	280
	Total Suspended Solids	50
	Oil and Grease	10
	Dissolved Iron	1.0
	pH, Units	6-9
23	Chloroform	0.01
114	Antimony	0.10
115	Arsenic	0.10
118	Cadmium	0.10
119	Chromium	0.10
120	Copper	0.10
122	Lead	0.10
124	Nickel	0.20
126	Silver	0.10
128	Zinc	0.10

TABLE VIII-21
BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS
PICKLING-HYDROCHLORIC ACID
BATCH-NEUTRALIZATION
PAGE 2

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(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Spent Acid Equalization
B: FHS Recycle
C: Equalization
D: Lime Addition
E: Polymer Addition
F: Aeration
G: Thickener
H: Vacuum Filter

TABLE VIII-22

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Hydrochloric Acid
: Continuous-Neutralization
: Carbon & Specialty

Model Size-TPD : 2760
Oper. Days/Year: 312
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	G(3)	H(3)	Total
Investment \$ x 10^{-3}	198	191	885	185	59	150	416	506	2590
Annual Cost \$ x 10^{-3}									
Capital	8.5	8.2	38.1	8.0	2.6	6.4	17.9	21.8	111.5
Depreciation	19.8	19.1	88.5	18.5	5.9	15.0	41.6	50.6	259.0
Operation & Maintenance	6.9	6.7	31.0	6.5	2.1	5.2	14.6	17.7	90.7
Sludge Disposal	-	-	-	-	-	-	-	159.1	159.1
Energy & Power	-	10.5(2)	2.0	0.6	2.1	1.4	15.6	15.6	37.3
Chemical Costs	-	-	-	126.8	21.3	-	-	-	148.1
TOTAL	35.2	34.0(2)	159.6	160.4	34.0	28.0	89.7	264.8	805.7

Effluent Quality(4)	BPT Effluent Level
Flow, gal/ton	280
Total Suspended Solids	50
Oil and Grease	10
Dissolved Iron	1.0
pH, Units	6-9
23 Chloroform	0.01
114 Antimony	0.10
115 Arsenic	0.10
118 Cadmium	0.10
119 Chromium	0.10
120 Copper	0.10
122 Lead	0.10
124 Nickel	0.20
126 Silver	0.10
128 Zinc	0.10

TABLE VIII-22
BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS
PICKLING-HYDROCHLORIC ACID
CONTINUOUS-NEUTRALIZATION
PAGE 2

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Spent Acid Equalization
B: FHS Recycle
C: Equalization
D: Lime Addition
E: Polymer Addition
F: Aeration
G: Thickener
H: Vacuum Filter

TABLE VIII-23

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Hydrochloric Acid
: Continuous-Acid Regeneration
: Carbon & Specialty

Model Size-TPD : 2760
Oper. Days/Year: 312
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	G	H(3)	I(3)	Total
Investment $ x 10^{-3}	198	4420	191	963	98	59	182	494	241	6846
Annual Cost $ x 10^{-3}										
Capital	8.5	190.0	8.2	41.4	4.2	2.5	7.8	21.2	10.4	294.2
Depreciation	19.8	442.0	19.1	96.3	9.8	5.9	18.2	49.4	24.1	684.6
Operation & Maintenance	6.9	154.7	6.7	33.7	3.4	2.1	6.4	17.3	8.4	239.6
Sludge Disposal(1)	-	-	-	-	-	-	-	-	18.1	18.1
Energy & Power	-	307.3	10.5(2)	41.9	1.0	0.6	2.8	1.4	4.9	359.9
Chemical Costs	-	-	-	-	27.4	29.2	-	-	-	56.6
TOTAL	35.2	1094.0	34.0(2)	213.3	45.8	40.3	35.2	89.3	65.9	1653.0
Less Credits										
Acid Recovery		2304.6								2304.6
Iron Oxide Recovery		1543.6								1543.6
Net Annual Cost	35.2	-2754.2	34.0(2)	213.3	45.8	40.3	35.2	89.3	65.9	-2195.2

	Effluent Quality(4)	BPT Effluent Level
	Flow, gal/ton	450
	Total Suspended Solids	50
	Oil and Grease	10
	Dissolved Iron	1.0
	pH, Units	6-9
23	Chloroform	0.01
114	Antimony	0.10
115	Arsenic	0.10
118	Cadmium	0.10
119	Chromium	0.10
120	Copper	0.10
122	Lead	0.10
124	Nickel	0.20
126	Silver	0.10
128	Zinc	0.10

TABLE VIII-23
BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS
PICKLING-HYDROCHLORIC ACID
CONTINUOUS-ACID REGENERATION
PAGE 2

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Spent Acid Storage System
B: Acid Regeneration
C: FHS Recycle
D: Equalization
E: Lime Addition
F: Polymer Addition
G: Aeration
H: Thickener
I: Vacuum Filter

TABLE VIII-24

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling - Combination Acid
: Batch-Other
: Carbon-Speciality

Model Size-TPD : 200
Oper. Days/Year: 260
Turns/Day : 2

C&TT Step	A	B	C	D	E(3)	F(3)	Total
Investment $ x 10^{-3}	52	88	92	40	85	162	519
Annual Cost $ x 10^{-3}							
Capital	2.2	3.8	3.9	1.7	3.7	7.0	22.3
Depreciation	5.2	8.8	9.2	4.0	8.5	16.2	51.9
Operation & Maintenance	1.8	3.1	3.2	1.4	3.0	5.7	18.2
Sludge Disposal(1)	-	-	-	-	-	2.1	2.1
Energy & Power	0.6(2)	0.2	0.3	0.2	0.2	1.3	2.2
Chemical Costs	-	-	7.5	0.8	-	-	8.3
TOTAL	9.2(2)	15.9	24.1	8.1	15.4	32.3	105.0

Effluent Quality(4)	BPT Effluent Level
Flow, gal/ton	200
Total Suspended Solids	25
Oil & Grease	10
Fluoride	15
Dissolved Iron	1.0
pH, Units	6-9
115 Arsenic	0.10
119 Chromium	0.50
120 Copper	0.10
122 Lead	0.10
124 Nickel	0.25
128 Zinc	0.10

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power, because a credit is supplied for existing process water requirements.
(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: PHS Recycle
B: Equalization and oil separation
C: Neutralization with lime
D: Flocculation with polymer
E: Clarifier
F: Vacuum Filter

TABLE VIII-25

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling - Combination Acid
: Batch-Pipe & Tube
: Carbon-Speciality

Model Size-TPD : 200
Oper. Days/Year: 260
Turns/Day : 2

C&TT Step	A	B	C	D	E(3)	F(3)	Total
Investment $ x 10^{-3}	52	208	109	56	154	192	771
Annual Cost $ x 10^{-3}							
Capital	2.2	8.9	4.7	2.4	6.6	8.2	33.0
Depreciation	5.2	20.8	10.9	5.6	15.4	19.2	77.1
Operation & Maintenance	1.8	7.3	3.8	1.9	5.4	6.7	26.9
Sludge Disposal	-	-	-	-	-	4.9	4.9
Energy & Power(1)	0.6(2)	0.1	0.4	0.2	0.2	1.7	2.6
Chemical Costs	-	-	9.3	2.7	-	-	12.0
TOTAL	9.2(2)	37.1	29.1	12.8	27.6	40.7	156.5

Effluent Quality(4)	BPT Effluent Level
Flow, gal/ton	700
Total Suspended Solids	25
Oil & Grease	10
Fluoride	15
Dissolved Iron	1.0
pH, Units	6-9
115 Arsenic	0.10
119 Chromium	0.50
120 Copper	0.10
122 Lead	0.10
124 Nickel	0.25
128 Zinc	0.10

---

(1) Costs are all power unless otherwise noted.
(2) Total does not include power, because a credit is supplied for existing process water requirements.
(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: FHS Recycle
B: Equalization and Oil Separation
C: Neutralization with Lime
D: Flocculation with Polymer
E: Clarifier
F: Vacuum Filter

TABLE VIII-26

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling - Combination Acid	Model Size-TPD :	500
:	Continuous	Oper. Days/Year:	320
:	Carbon-Speciality	Turns/Day :	3

C&TT Step	A	B	C	D	E(3)	F(3)	Total
Investment \$ x 10^{-3}	83	239	166	77	245	216	1116
Annual Cost \$ x 10^{-3}							
Capital	3.6	14.1	7.1	3.3	10.5	9.3	47.9
Depreciation	8.3	32.9	16.6	7.7	24.5	21.6	111.6
Operation & Maintenance	2.9	11.5	5.8	2.7	8.6	7.6	39.1
Sludge Disposal(1)	-	-	-	-	-	6.2	6.2
Energy & Power	2.1(2)	0.3	1.0	0.9	1.4	6.3	9.9
Chemical Costs	-	-	32.0	12.1	-	-	8.3
TOTAL	14.8(2)	58.8	62.5	26.7	45.0	51.0	258.8

Effluent Quality(4)	BPT Effluent Level
Flow, gal/ton	1000
Total Suspended Solids	25
Oil & Grease	10
Fluoride	15
Dissolved Iron	1.0
pH, Units	6-9
4 Benzene	0.05
115 Arsenic	0.10
119 Chromium	0.50
120 Copper	0.10
122 Lead	0.10
124 Nickel	0.25
128 Zinc	0.10

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power, because a credit is supplied for existing process water requirements.

(3) Treatment components are used in tandem.

(4) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: FHS Recycle	D: Flocculation with polymer
B: Equalization and oil separation	E: Clarifier
C: Neutralization with lime	F: Vacuum Filter

TABLE VIII-27

BPT CAPITAL COST TABULATION

BASIS: 7/1/78 DOLLARS x 10^{-3}
: FACILITIES IN PLACE AS OF 1/1/78

Subcategory: Pickling-Sulfuric Acid
: Batch Neutralization
: Carbon & Speciality

Plant Code	TPD	C&TT Step A	B	C	D	E	In Place	Required	Total
0048F	117	50	53	159	41	25	237	91	328
0060H	816	160	171	511	133	80	922	133	1055
0088A	1594	238	256	764	198	120	238	1338	1576
0088D	769	154	166	493	106-22	78	997	22	1019
0112	560	127	137	408	106	64	0	842	842
0112A	1029	183	197	587	153	93	1030	183	1213
0112C	2886	340	366	1091	283	172	1629	623	2252
0112F	827	161	173	515	134	81	334	730	1064
0112G	44	28	30	89	23	14	30	154	184
0112I	287	85	92	273	71	43	408	156	564
0240A	585	131	140	419	109	66	625	240	865
0240B	687	144	155	461	120	73	689	264	953
0256F	90	42	46	136	35	21	280	0	280
0256G	471	115	123	368	96	58	664	96	760
0432A	1805	257	276	823	214	130	1700	0	1700
0460A	1281	209	225	670	174	106	1175	209	1384
0460C	105	47	50	149	39	24	270	39	309
0460D	239	76	82	245	64	39	430	76	506
0460E	190	64	69	206	54	33	69	357	426
0460F	28	21	23	68	18	11	23	118	141
0460G	225	74	79	236	61	37	352	135	487
0476A	250	78	84	251	65	40	440	78	518
0492A	474	115	124	369	96	58	551	211	762
0612	1137	195	209	624	162	98	1093	195	1288

TABLE VIII-27
BPT CAPITAL COST TABULATION
BASIS: 7/1/78 DOLLARS x 10^{-3}
: FACILITIES IN PLACE AS OF 1/1/78
PAGE 2

Plant Code	TPD	C&TT Step A	B	C	D	E	In Place	Required	Total
0640	758	153	164	489	127	77	730	280	1010
0684G	1143	195	210	626	163	99	1098	195	1293
0684Q	372	100	107	319	83	50	659	0	659
0728	75	38	41	122	32	19	220	32	252
0856F	378	101	108	322	84	51	481	185	666
0856S	222	73	78	234	61	37	151	332	483
0856U	186	66	71	210	55	33	71	364	435
0860F	1083	189	203	606	157	95	904	346	1250
0860G	735	150	161	480	125	76	842	150	992
0864B	651	139	150	446	116	70	782	139	921
0868A	573	129	139	413	107	65	617	236	853
0884C	18	16	17	52	13	8	17	89	106
0884D	18	16	17	52	13	8	17	89	106
0884G	8	10	11	32	8	5	43	18	61
0948A	189	66	71	213	55	33	438	0	438
							24,182*	10,554*	34,736*

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*Total includes confidential plants.

NOTE:

Underlined costs represent facilities in-place, where two figures appear in the same column, the underlined portion is in-place; the new non-underlined portion remains to be installed.

KEY TO C&TT STEPS

A: Spent Acid Equalization	D: Polymer Addition, Aeration
B: FBS Recycle	E: Settling Basin
C: Equalization and Lime Addition	

TABLE VIII-28

BPT CAPITAL COST TABULATION

Subcategory: Pickling - Sulfuric Acid
: Batch Acid Recovery
: Carbon & Specialty

Basis: 7/1/78 Dollars x 10^{-3}
: Facilities In Place as of 1/1/78

Plant Code	TPD	C&TT Step A	C&TT Step B	In Place	Required	Total
0048B	450	112	2499	0	2,611	2,611
0060C	63	34	768	34	768	802
0068	94	44	977	44	977	1,021
0112B	240	77	1714	0	1,791	1,791
0112I	282	84	1888	1888	84	1,972
0240C	102	46	1026	0	1,026	1,026
0384A	501	119	2665	0	2,784	2,784
0432E	30	22	492	22	492	514
0432L	323	91	2048	91	2,048	2,139
0460H	94	44	977	0	1,021	1,021
0584C	462	113	2539	113	2,539	2,652
0684D	1400	221	4937	221	4,937	5,158
0684E	1650	243	5449	243	5,449	5,692
0684H	636	137	3075	137	3,075	3,212
0684P	603	133	2979	133	2,979	3,112
0684V	150	58	1293	0	1,351	1,351
0856N	846	163	3650	163	3,650	3,813
0856P	1599	239	5347	239	5,347	5,586
0856Q	15	15	325	15	325	340
0856R	351	96	2153	96	2,153	2,249
0856T	258	80	1790	80	1,790	1,870
0916A	612	134	3005	134	3,005	3,139
0920D	267	82	1827	82	1,827	1,909
0948B	306	89	1983	89	1,983	2,072
				3824*	60,969*	64,793*

NOTE: Underlined costs represent facilities in place. Where two figures appear in the same column, the underlined portion is in place; the non-underlined portion remains to be installed.

*: Totals include confidential plants.

KEY TO C&TT STEPS

A: Spent Acid Storage System
B: Acid Recovery System

TABLE VIII-29

BPT CAPITAL COST TABULATION

Subcategory: Pickling - Sulfuric Acid
: Continuous Neutralization
: Carbon & Specialty

Basis: 7/1/78 Dollars x 10^{-3}
: Facilities In Place as of 1/1/78

Plant Code	TPD	C&TT Steps A	B	C	D	E	In Place	Required	Total
0012A	11,031	638	479	2121	418	326	3,344	638	3,982
0020B	801	132	99	440	87	68	826	0	826
0060D	1,194	147	111	490	97	75	676	244	920
0112D	1,156	165	124	548	108	84	864	165	1,029
0176	60	28	21	93	18	14	174	0	174
0256A	414	89	67	296	58	45	156	399	555
0256B	423	90	68	300	59	46	68	495	563
0432A	2,088	235	176	781	154	120	1,466	0	1,466
0432B	1,686	207	155	687	136	106	362	929	1,291
0476A	127	44	33	146	29	22	230	44	274
0528A	2,577	266	200	886	175	136	266	1,397	1,663
0580C	45	23	18	78	12	15	41	105	146
0584E	4,458	370	278	1232	243	189	1,942	370	2,312
0684C	1,014	152	114	507	100	78	266	685	951
0792C	486	98	74	326	64	50	514	98	612
0856D	9,650	588	422	1957	386	301	0	3,674	3,674
0856F	2,560	265	199	883	174	136	1,483	174	1,657
0856U	339	79	59	262	52	40	59	433	492
0846B	2,166	240	180	799	158	123	1,260	240	1,500
0868A	3,525	322	241	1070	211	164	1,686	322	2,008
0948C	5,844	436	327	1449	286	222	2,284	436	2,720
							17,967	10,848	28,815

NOTE: Underlined costs represent facilities in place. Where two figures appear in the same column, the underlined portion is in place; the non-underlined portion remains to be installed.

KEY TO C&TT STEPS

A: Spent Acid Equalization
B: FHS Recycle
C: Equalization & Lime Addition
D: Polymer Addition, Aeration
E: Settling Basin

TABLE VIII-30

BPT CAPITAL COST TABULATION

Subcategory: Pickling - Sulfuric Acid
: Continuous Acid Recovery
: Carbon & Specialty

Basis: 7/1/78 Dollars x 10^{-3}
: Facilities In Place as of 1/1/78

Plant Code	TPD	C&TT Step A	C&TT Step B	In Place	Required	Total
0384A	84	40	794	0	834	834
0432M	307	86	1727	86	1727	1813
0580	4	6	128	0	134	134
0760	482	113	2264	0	2377	2377
0792B	480	113	2258	2258	113	2371
0856E	297	84	1693	0	1777	1777
				2344	6962	9306

NOTE: Underlined costs represent facilities in place. Where two figures appear in the same column, the underlined portion is in place; the non-underlined portion remains to be installed.

KEY TO C&TT STEPS

A: Spent Acid Storage System
B: Acid Recovery System

TABLE VIII-31

BPT CAPITAL COST TABULATION

Subcategory: Pickling - Hydrochloric Acid
: Batch Neutralization
: Carbon & Specialty

Basis: 7/1/78 Dollars x 10^{-3}
: Facilities In Place as of 1/1/78

Plant Code	TPD	C&TT Step A	B	C	D	E	F	G	H	In Place	Required	Total
0060L	0.4	1	2	9	2	1	2	5	7	2	27	29
0176	16	12	17	85	19	12	19	50	63	98	179	277
0384A	768	127	176	865	197	118	199	506	640	506	2322	2828
0580A	4	5	7	37	8	5	8	22	27	42	77	119
0864B	273	68	94	465	106	63	107	272	344	642	877	1519
										1290*	3482*	4772*

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*: Totals do not include confidential plants.

NOTE: Underlined costs represent facilities in place. Where two figures appear in the same column, the underlined portion is in place; the non-underlined portion remains to be installed.

KEY TO C&TT STEPS

A: Spent Acid Equalization
B: FHS Recycle
C: Equalization
D: Lime Addition
E: Polymer Addition
F: Aeration
G: Thickener
H: Vacuum Filter

TABLE VIII-32

BPT CAPITAL COST TABULATION

Subcategory: Pickling - Hydrochloric Acid
: Continuous
: Neutralization
: Carbon & Specialty

Basis: 7/1/78 Dollars x 10^{-3}
: Facilities In Place as of 1/1/78

Plant Code	TPD	C&TT Step A	B	C	D	E	F	G	H	In Place	Required	Total
0020C	582	78	75	348	73	23	59	163	199	940	78	1,018
0060	8107	378	365	1689	353	113	286	794	966	4,566	378	4,944
0060D	207	42	40	187	39	12	32	88	107	266	281	547
0112B	5592	302	292	1352	282	90	229	635	773	2,279	1,676	3,955
0112D	8517	389	376	1740	364	116	295	818	995	1,298	3,795	5,093
0112H	40	16	15	70	15	5	12	33	40	150	56	206
0320	7075	348	336	1557	325	104	264	732	890	3,318	1,238	4,556
0384A	3708	236	228	1056	221	70	179	497	604	497	2,594	3,091
0396D	1134	116	112	519	108	35	88	244	297	998	521	1,519
0432C	4452	264	254	1179	246	79	200	554	674	2,512	938	3,450
0432D	3678	235	227	1051	220	70	178	494	601	2,020	1,056	3,076
0448A	2797	200	193	892	186	59	151	419	510	186	2,424	2,610
0580A	4	4	4	18	4	1	3	8	10	34	18	52
0580C	18	10	9	43	9	3	7	20	25	9	117	126
0580D	105	28	27	124	26	8	21	59	71	265	99	364
0580E	90	25	24	113	24	8	19	53	65	24	307	331
0580F	90	25	24	113	24	8	19	53	65	24	307	331
0584A	9948	427	412	1910	399	127	324	898	1092	1,424	4,165	5,589
0612	234	45	43	201	42	13	34	95	115	428	160	588
0684F	4824	277	267	1237	259	82	210	582	707	2,637	984	3,621
0856F	2388	182	175	811	170	54	138	381	464	1,729	646	2,375
0856S	24	11	11	51	11	3	9	24	29	11	138	149
0860F	69	22	21	97	20	6	16	45	55	238	44	282
0864B	3492	228	220	1019	213	68	173	479	583	2,172	811	2,983
0868A	1590	142	137	636	133	42	108	299	363	1,355	505	1,860
0920A	3399	224	216	1003	210	67	170	471	573	1,321	1,613	2,934
0920C	2446	184	178	823	172	55	140	387	471	2,225	184	2,409
0920G	2133	170	164	758	158	51	129	356	434	1,616	604	2,220
0948A	2637	193	186	861	180	57	146	405	492	1,835	193	2,028
										36,377	25,930	62,307

NOTE: Underlined costs represent facilities in place. Where two figures appear in the same column, the underlined portion is in place; the non-underlined portion remains to be installed.

[illegible] C&TT STEPS

A: Spent Acid Equalization
B: FHS Recycle
C: Equalization
D: Lime Addition
E: Polymer Addition
F: Aeration
G: Thickener
H: Vacuum Filter

TABLE VIII-33

BPT CAPITAL COST TABULATION

Subcategory: Pickling - Hydrochloric Acid
: Continuous
: Regeneration
: Carbon & Specialty

Basis: 7/1/78 Dollars x 10^{-3}
: Facilities In Place as of 1/1/78

Plant Code	TPD	A	B	C	D	E	F	G	H	I	In Place	Required	Total
		C&TT Steps											
0068	193	40	896	39	195	20	12	37	100	49	0	1,388	1,388
0384A	2808	200	4466	193	973	99	60	184	500	244	500	6,419	6,919
0528B	2196	173	3854	167	839	85	51	159	431	210	4,370	1,599	5,969
0580	125	31	690	30	150	15	9	28	77	38	0	1,068	1,068
0580B	105	28	622	27	135	14	8	26	69	34	0	963	963
0584C	3066	211	4708	203	1026	104	63	194	526	257	526	6,766	7,292
0584F	8325	384	8572	370	1868	190	114	353	958	467	9,530	3,746	13,276
0684B	2733	197	4394	190	957	97	59	181	491	240	491	6,315	6,806
0684I	1377	130	2912	126	635	65	39	120	325	159	3,302	1,209	4,511
0856P	17	9	209	9	45	5	3	9	23	11	0	323	323
											18,719*	29,796*	48,515*

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*: Totals do not include confidential plants.

NOTE: Underlined costs represent facilities in place. Where two figures appear in the same column, the underlined portion is in place; the non-underlined portion remains to be installed.

KEY TO C&TT STEPS

A: Spent Acid Storage
B: Acid Regeneration System
C: FHS Recycle
D: Equalization
E: Lime Addition
F: Polymer Addition
G: Aeration
H: Thickener
I: Vacuum Filter

TABLE VIII-34

BPT CAPITAL COST TABULATION

BASIS: 7/1/78 DOLLARS x 10^{-3}
: FACILITIES IN PLACE AS OF 1/1/78

Subcategory: Combination Acid Pickling
: Batch
: Carbon & Speciality

		C&TT Step								
Plant Code	TPD	A	B	C	D	E	F	In Place	Required	Total
0020B	99	-	$\underline{113}$	$\underline{70}$	$\underline{35}$	$\underline{89}$	$\underline{103}$	410	0	419
0060I	117	-	$\underline{160}$	$\underline{99}$	50	126	146	259	322	581
0060N	10	-	$\underline{28}$	$\underline{18}$	9	22	26	46	57	103
0060P	26	-	$\underline{50}$	$\underline{31}$	16	$\underline{40}$	46	121	62	183
0068	381	-	253	137	79	199	232	0	920	920
0088A	72	-	$\underline{93}$	$\underline{58}$	$\underline{29}$	$\underline{73}$	$\underline{85}$	338	0	338
0088C	546	-	314	195	984	247	288	0	1142	1142
0088D	52	-	$\underline{77}$	$\underline{48}$	24	60	70	125	154	279
0112A	1044	-	$\underline{463}$	$\underline{288}$	$\underline{145}$	$\underline{364}$	$\underline{425}$	1685	0	1685
0112C	882	-	$\underline{418}$	$\underline{260}$	131	$\underline{329}$	384	1007	515	1522
0112H	552	-	$\underline{316}$	$\underline{196}$	99	$\underline{249}$	290	761	389	1150
0176	728	$\underline{113}$	$\underline{373}$	$\underline{232}$	$\underline{117}$	$\underline{294}$	$\underline{342}$	1471	0	1471
0176C	23	-	47	29	15	37	43	0	171	171
0176D	9	8	27	17	8	21	25	0	106	106
0248C	260	61	201	125	63	158	184	0	792	792
0248D	37	19	62	$\underline{39}$	20	$\underline{49}$	57	88	158	246
0248E	5	6	19	12	6	13	17	0	75	75
0248F	1	2	7	$\underline{4}$	2	$\underline{6}$	7	10	18	28
0256F	30	$\underline{17}$	$\underline{55}$	$\underline{34}$	$\underline{17}$	$\underline{43}$	50	166	50	216
0256H	0.3	-	3	$\underline{2}$	1	$\underline{3}$	3	5	7	$\underline{12}$
0256L	84	31	102	$\underline{63}$	$\underline{32}$	$\underline{80}$	94	175	227	402
0284A	177	48	160	$\underline{99}$	$\underline{50}$	$\underline{126}$	146	275	354	629
0424	211	-	$\underline{177}$	$\underline{110}$	$\underline{56}$	140	163	343	303	646
0432E	15	11	36	23	11	29	33	0	143	143
0440A	237	-	190	118	60	150	174	0	692	692
0476A	386	-	$\underline{255}$	$\underline{158}$	$\underline{80}$	$\underline{201}$	$\underline{234}$	928	0	928
0496	411	$\underline{80}$	$\underline{265}$	$\underline{165}$	83	$\underline{208}$	243	718	326	1044
0548A	63	-	$\underline{86}$	$\underline{53}$	27	$\underline{68}$	79	207	106	313
0548B	42	-	67	$\underline{42}$	21	53	62	42	203	245
0580	45	-	70	44	22	55	64	0	255	255
0636	-	-	-	-	-	-	-	-	-	-
0684P	96	19	145	90	46	115	133	0	548	548
0684U	194	-	169	105	53	133	155	0	615	615
0684V	194	51	169	105	53	133	155	0	666	666

TABLE VIII-34
BPT CAPITAL COST TABULATION
BASIS: 7/1/78 DOLLARS x 10^{-3}
: FACILITIES IN PLACE AS OF 1/1/78
PAGE 2

Plant Code	TPD	C&TT Step A	C&TT Step B	C&TT Step C	C&TT Step D	C&TT Step E	C&TT Step F	In Place	Required	Total
0728	75	-	95	59	30	75	88	0	347	347
0776F	26	-	50	31	16	40	46	97	86	183
0776G	5	-	19	12	6	15	17	52	17	69
0776H	13	-	33	21	10	26	31	47	74	121
0776J	8	-	25	15	8	20	23	40	51	91
0792A	54	-	78	49	25	62	72	0	286	286
0856E	78	-	98	61	31	77	90	159	198	357
0856H	125	39	130	81	41	102	119	313	199	512
0884E	24	15	48	30	15	38	44	45	145	190
0884F	5	-	19	12	6	15	17	0	69	69
								*10104	*11482	*21586

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*Total includes confidential plants.

NOTE:

Underlined costs represent facilities in-place, where two figures appear in the same column, the underlined portion is in-place; the new non-underlined portion remains to be installed.

KEY TO C&TT STEPS

A: FHS Recycle
B: Equalization with oil separation
C: Lime Addition
D: Polymer Addition
E: Clarifier
F: Vacuum Filter

TABLE VIII-35

BPT CAPITAL COST TABULATION

BASIS: 7/1/78 DOLLARS x 10^{-3}
: FACILITIES IN PLACE AS OF 1/1/78

Subcategory: Combination Acid Pickling
: Batch
: Carbon & Speciality

Plant Code	TPD	A	B	C	D	E	F	In Place	Required	Total
					C&TT Step					
0020B	534	69	508	228	108	357	312	1,513	69	1,582
0020C	906	95	697	313	149	490	429	2,078	95	2,173
0020L	386	57	417	188	89	296	257	1,245	57	1,302
0060	308	49	365	164	78	256	224	1,087	49	1,136
0060D	1,833	145	1,064	477	227	747	654	2,433	881	3,314
0060E	100	25	186	83	40	131	114	254	325	579
0112A	96	25	181	85	39	127	111	543	25	568
0112C	131	29	218	98	47	154	134	316	364	680
0176	128	29	215	96	46	151	132	669	0	669
0248B	1,877	147	1,079	484	230	759	663	3,362	0	3,362
0256O	577	72	532	239	113	374	327	798	859	1,657
0284A	161	34	247	111	53	174	152	585	186	771
0432K	759	85	627	281	134	441	385	722	1,231	1,953
0432L	34	13	97	43	21	68	60	0	302	302
0648	129	29	216	97	46	152	133	97	576	673
0684D	1,083	105	776	348	165	54	477	545	1,871	2,416
0860B	390	57	420	189	89	295	258	0	1,308	1,308
0860F	45	16	115	52	25	81	71	319	41	360
0948F	82	22	165	74	35	116	101	22	491	513
								16,588	8,730	25,318

NOTE:

Underlined costs represent facilities in-place, where two figures appear in the same column, the underlined portion is in-place; the new non-underlined portion remains to be installed.

KEY TO C&TT STEPS

A: FHS Recycle	D: Polymer Addition
B: Equalization with oil separation	E: Clarifier
C: Lime Addition	F: Vacuum Filter

TABLE VIII-36

BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Sulfuric Acid
: Batch
: Neutralization

Model Size-TPD : 500
Oper. Days/Year : 260
Turns/Day : 3

C&TT Step	Alternate 1 G	Alternate 1 Total	2-Alternate 1 plus: H	2-Alternate 1 plus: I	2-Alternate 1 plus: Total	3-Alternate 1 plus: J	3-Alternate 1 plus: K	3-Alternate 1 plus: Total
Investment $ x 10^{-3}	114	114	34	118	226	1256	66	1436
Annual Cost $ x 10^{-3}								
Capital	4.9	4.9	1.5	5.1	11.4	54.0	2.8	61.7
Depreciation	11.4	11.4	3.4	11.8	26.6	125.6	6.6	143.6
Operation & Maintenance	4.0	4.0	1.2	4.1	7.3	44.0	2.3	50.3
Sludge Disposal	-	-	-	-	-	1.8	-	1.8
Energy & Power	-	-	0.2	1.8	2.0	23.8	0.2	24.0
Replacement Parts	15.2	15.2	-	-	15.2	-	-	15.2
Chemical Costs	-	-	0.7	-	0.7	-	-	-
TOTAL	35.5	35.5	7.0	22.8	65.3	249.2	11.9	296.6

	Effluent Quality(1)	BAT Feed Level	Alternate 1 Total	2-Alternate 1 plus: Total	3-Alternate 1 plus: Total
	Flow, gal/ton	360	70	70	0
	Suspended Solids	30	30	15	-
	Oil & Grease	10	10	5.0	-
	Dissolved Iron	1.0	1.0	1.0	-
	pH, Units	6-9	6-9	6-9	-
115	Arsenic	0.10	0.10	0.10	-
118	Cadmium	0.10	0.10	0.10	-
119	Chromium	0.10	0.10	0.10	-
120	Copper	0.10	0.10	0.10	-
122	Lead	0.10	0.10	0.10	-
124	Nickel	0.20	0.20	0.10	-
128	Zinc	0.10	0.10	0.10	-

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(1) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cascade Rinse
H. Sulfide Precipitation
I: Filtration
J: Evaporation System
K: Recycle 100%

TABLE VIII-37

BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling-Sulfuric Acid	Model Size-TPD :	1980
:	Continuous	Oper. Days/Year :	260
:	Neutralization	Turns/Day :	3
:	Carbon & Specialty		

C&TT Step	Alternate 1		2-Alternate 1 plus:			3-Alternate 1 plus:		
	G	Total	H	I	Total	J	K	Total
Investment $ x 10^{-3}	323	323	64	157	544	234.6	83	2752
Annual Cost $ x 10^{-3}								
Capital	13.9	13.9	2.8	6.7	23.4	100.9	3.6	118.4
Depreciation	32.3	32.3	6.4	15.7	54.4	234.6	8.3	275.2
Operation & Maintenance	11.3	11.3	2.2	5.5	19.0	82.1	2.9	96.3
Sludge Disposal	-	-	-	-	-	4.3	-	4.3
Energy & Power(1)	-	-	0.3	2.2	2.5	58.2	0.3	58.5
Replacement Parts	42.8	42.8	-	-	42.8	-	-	42.8
Chemical Cost	-	-	1.4	-	1.4	-	-	-
TOTAL	100.3	100.3	13.1	30.1	143.5	480.1	15.1	595.5

	Effluent Quality(1)	BAT Feed Level	Alternate 1 Total	2-Alternate 1 plus: Total	3-Alternate 1 plus: Total
	Flow, gal/ton	250	55	55	0
	Suspended Solids	30	30	15	-
	Oil & Grease	10	10	5.0	-
	Dissolved Iron	1.0	1.0	1.0	-
	pH	6-9	6-9	6-9	-
115	Arsenic	0.10	0.10	0.10	-
118	Cadmium	0.10	0.10	0.10	-
119	Chromium	0.10	0.10	0.10	-
120	Copper	0.10	0.10	0.10	-
122	Lead	0.10	0.10	0.10	-
124	Nickel	0.20	0.20	0.10	-
128	Zinc	0.10	0.10	0.10	-

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(1) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

G:	Cascade Rinse	J:	Evaporation System
H:	Sulfide Precipitation	K:	Recycle 100%
I:	Filtration		

TABLE VIII-38

BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling-Hydrochloric Acid	Model Size-TPD :	190
:	Batch Neutralization	Oper. Days/Year :	260
:	Carbon & Specialty	Turns/Day :	2

	1		2 Alternate 1 plus:			3 Alternate 1 plus:		
C&TT Step	I	Total	J(1)	K(1)	Total	L(1)	M(1)	Total
Investment \$ x 10^{-3}	63	63	29	72	164	1292	58	1413
Annual Cost \$ x 10^{-3}								
Capital	2.7	2.7	1.2	3.1	7.1	55.6	2.5	60.7
Depreciation	6.3	6.3	2.9	7.2	16.4	129.2	5.8	141.3
Operation & Maintenance	2.2	2.2	1.0	2.5	5.7	45.2	2.0	49.5
Sludge Disposal	-	-	-	-	-	-	-	-
Energy & Power(1)	-	-	0.1	0.2	0.3	12.1	0.2(2)	12.1
Replacment Parts	8.3	8.3	-	-	8.3	-	-	8.3
Chemical Costs	-	-	0.2	-	0.2	-	-	-
TOTAL	19.5	19.5	5.4	13.0	38.0	242.1	10.3(2)	271.9

	Effluent Quality(4)	BAT Feed Level	1 Total	2 Total	3 Total
	Flow, gal/ton	560	90	90	0
	Suspended Solids	30	30	15	-
	Oil & Grease	10	10	5.0	-
	Dissolved Iron	1.0	1.0	1.0	-
	pH, Units	6-9	6-9	6-9	-
23	Chloroform	0.01	0.01	0.01	-
114	Antimony	0.10	0.10	0.10	-
115	Arsenic	0.10	0.10	0.10	-
118	Cadmium	0.10	0.10	0.10	-
119	Chromium	0.10	0.10	0.10	-
120	Copper	0.10	0.10	0.10	-
122	Lead	0.10	0.10	0.10	-
124	Nickel	0.20	0.20	0.10	-
126	Silver	0.10	0.10	0.10	-
128	Zinc	0.10	0.10	0.10	-

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(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

I: Cascade Rinse
J: Sulfide Precipitation
K: Filtration
L: Evaporation System
M: Recycle

TABLE VIII-39

BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Hydrochloric Acid
: Continuous Neutralization
: Carbon & Specialty

Model Size-TPD : 2760
Oper. Days/Year : 312
Turns/Day : 3

		1		2 Alternate 1 plus:			3 Alternate 1 plus:		
C&TT Step		I	Total	J(1)	K(1)	Total	L(1)	M(1)	Total
Investment, $ x 10^{-3}		293	293	24	153	470	2003	33	2329
Annual Cost $ x 10^{-3}									
Capital		12.6	12.6	1.0	6.6	20.2	86.1	1.4	100.1
Depreciation		29.3	29.3	2.4	15.3	47.0	200.3	3.3	232.9
Operation & Maintenance		10.3	10.3	0.8	5.4	16.5	70.1	1.2	81.5
Sludge Disposal(1)		-	-	-	-	-	-	-	-
Energy & Power		-	-	0.1	0.6	0.7	122.6	1.0(2)	123.6
Replacement Parts		38.9	38.9	-	-	38.9	-	-	38.9
Chemical Costs		-	-	1.0	-	1.0	-	-	-
TOTAL		91.1	91.1	5.3	27.9	124.3	479.1	6.9(2)	577.0
Effluent Quality(4)	BAT Feed Level								
Flow, gal/ton	320		55			55			0
Suspended Solids	30		30			15			-
Oil & Grease	10		10			5.0			-
Dissolved Iron	1.0		1.0			1.0			-
pH, Units	6-9		6-9			6-9			-
23 Chloroform	0.01		0.01			0.01			-
114 Antimony	0.10		0.10			0.10			-
115 Arsenic	0.10		0.10			0.10			-
118 Cadmium	0.10		0.10			0.10			-
119 Chromium	0.10		0.10			0.10			-
120 Copper	0.10		0.10			0.10			-
122 Lead	0.10		0.10			0.10			-
124 Nickel	0.20		0.20			0.10			-
126 Silver	0.10		0.10			0.10			-
128 Zinc	0.10		0.10			0.10			-

---

(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

I: Cascade Rinse
K: Filtration
M: Recycle
J: Sulfide Precipitation
L: Evaporation

TABLE VIII-40

BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling-Hydrochloric Acid	Model Size-TPD	:	2760
:	Continuous-Acid Neutralization	Oper. Days/Year	:	312
:	Carbon & Specialty	Turns/Day	:	3

	1		2 Alternate 1 plus:			3 Alternate 1 plus:		
C&TT Step	I	Total	J$^{(1)}$	K$^{(1)}$	Total	L$^{(1)}$	M$^{(1)}$	Total
Investment, $ x 10^{-3}	339	339	31	192	562	2398	40	2877
Annual Cost $ x 10^{-3}								
Capital	14.6	14.6	1.3	8.3	24.2	115.7	1.7	123.7
Depreciation	33.9	33.9	3.1	19.2	56.2	249.8	4.0	287.7
Operation & Maintenance	11.9	11.9	1.1	6.7	19.7	87.4	1.4	100.7
Sludge Disposal	-	-	-	-	-	-	-	-
Energy & Power$^{(1)}$	-	-	0.2	1.0	1.2	191.3	1.8$^{(2)}$	191.3
Replacement Parts	45.0	45.0	-	-	45.0	-	-	45.0
Chemical Costs	-	-	1.5	-	1.5	-	-	-
TOTAL	105.4	105.4	7.2	35.2	147.8	644.2	7.1	748.4

	Effluent Quality$^{(4)}$	BAT Feed Level	1	2	3
	Flow, gal/ton	430	70	70	0
	Suspended Solids	30	30	15	-
	Oil & Grease	10	10	5.0	-
	Dissolved Iron	1.0	1.0	1.0	-
	pH, Units	6-9	6-9	6-9	-
23	Chloroform	0.01	0.01	0.01	-
114	Antimony	0.10	0.10	0.10	-
115	Arsenic	0.10	0.10	0.10	-
118	Cadmium	0.10	0.10	0.10	-
119	Chromium	0.10	0.10	0.10	-
120	Copper	0.10	0.10	0.10	-
122	Lead	0.10	0.10	0.10	-
124	Nickel	0.20	0.20	0.10	-
126	Silver	0.10	0.10	0.10	-
128	Zinc	0.10	0.10	0.10	-

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(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

I: Cascade Rinse	J: Sulfide Precipitation
K: Filtration	L: Evaporation
M: Recycle	

TABLE VIII-41

BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Combination Acid Pickling
: Batch
: Carbon & Specialty

Model Size-TPD : 200
Oper. Days/Year : 260
Turns/Day : 2

		1		2-Alternate 1 plus:			3-Alternate 1 plus:		
C&TT Step		**G**	**Total**	**H**	**I**	**Total**	**J**	**K**	**Total**
Investment, $ x 10^{-3}		69	69	25	97	191	1467	24	1559
Annual Cost $ x 10^{-3}									
Capital		3.0	3.0	1.1	4.2	8.2	63.1	1.0	67.0
Depreciation		6.9	6.9	2.5	9.7	19.1	146.7	2.4	155.9
Operation & Maintenance		2.4	2.4	0.9	3.4	6.7	51.3	0.8	54.6
Sludge Disposal		-	-	-	-	-	-	-	-
Energy & Power(1)		-	-	0.1	0.2	0.3	13.7	0.2(2)	13.8
Chemical Costs		9.1	9.1	0.1	-	9.1	-	-	-
Replacement Costs		-	-	-	-	1.5	-	-	9.1
TOTAL		21.4	21.4	4.7	17.5	43.5	274.8	4.2(2)	300.4
Effluent Quality(3)	**BAT Feed Level**								
Flow, gal/ton	545		105			105			0
Suspended Solids	30		30			15			-
Oil & Grease	2.0		2.0			2.0			-
Fluoride	15		15			15			-
Dissolved Iron	1.0		1.0			1.0			-
pH, Units	6-9		6-9			6-9			-
120 Copper	0.10		0.10			0.10			-
119 Chromium	0.10		0.10			0.10			-
124 Nickel	0.20		0.20			0.10			-
115 Arsenic	0.10		0.10			0.10			-
122 Lead	0.10		0.10			0.10			-
128 Zinc	0.10		0.10			0.10			-

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(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cascade Rinse	J: Evaporation
H: Sulfide Precipitation	K: Recycle
I: Filtration	

TABLE VIII-42

BAT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Combination Acid Pickling	Model Size-TPD	:	500
:	Continuous	Oper. Days/Year	:	320
:	Carbon & Specialty	Turns/Day	:	3

	1		2-Alternate 1 plus:			3-Alternate 1 plus:		
C&TT Step	G	Total	H	I	Total	J	K	Total
Investment, \$ $\times 10^{-3}$	142	142	41	191	374	2473	38	2653
Annual Cost \$ $\times 10^{-3}$								
Capital	6.1	6.1	1.8	8.2	16.1	106.3	1.6	114.0
Depreciation	14.2	14.2	4.1	19.1	37.4	247.3	3.8	265.3
Operation & Maintenance	5.0	5.0	1.4	6.7	13.1	86.6	1.3	92.9
Sludge Disposal	-	-	-	-	-	-	-	-
Energy & Power(1)	-	-	0.2	0.9	1.1	122.3	0.7(2)	122.3
Chemical Costs	-	-	0.9	-	0.9	-	-	-
Replacement Parts	18.8	18.8	-	-	18.8	-	-	18.8
TOTAL	44.1	44.1	8.4	34.9	87.4	562 5	6.7(2)	613.3

	Effluent Quality(3)	BAT Feed Level	1 Total	2 Total	3 Total
	Flow, gal/ton	1865	335	335	0
	Suspended Solids	30	30	15	-
	Oil & Grease	2.0	2.0	2.0	-
	Fluoride	15	15	15	-
	Dissolved Iron	1.0	1.0	1.0	-
	pH, Units	6-9	6-9	6-9	-
4	Benzene	0.05	0.05	0.025	-
115	Arsenic	0.10	0.10	0.10	-
119	Chromium	0.10	0.10	0.10	-
120	Copper	0.10	0.10	0.10	-
122	Lead	0.10	0.10	0.10	-
124	Nickel	0.20	0.20	0.10	-
128	Zinc	0.10	0.10	0.10	-

---

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cascade Rinse
H: Sulfide Precipitation
I: Filtration
J: Evaporation
K: Recycle

TABLE VIII-43

RESULTS OF BCT COST TEST
SULFURIC ACID PICKLING SUBCATEGORY

(Neutralization Systems Only)

A. Batch Type

BCT-1: lbs/year removed = 29,383
Cost of BCT-1* = $35,500 $/lb = 1.74 FAIL
*Includes the cost of all BAT components

BCT-2: lbs/year removed = 21,901
Cost of BCT-2* = $58,300 $/lb = 2.66 FAIL
*Includes the cost of all BAT components except sulfide precipitation.

B. Continuous Type

BCT-1: lbs/year removed = 48,485
Cost of BCT-1* = $100,300 $/lb = 2.07 FAIL
*Includes the cost of all BAT components.

BCT-2 lbs/year removed = 53,256
Cost of BCT-2* = $130,400 $/lb = 2.45 FAIL
*Includes the cost of all BAT components except sulfide precipitation.

TABLE VIII-44

RESULTS OF BCT COST TEST
HYDROCHLORIC ACID PICKLING SUBCATEGORY

(Neutralization Systems)

A. Batch Type

BCT-1: lbs/year removed = 5,420
Cost of BCT-1* = $19,500 $/lb = 3.60 FAIL
*Includes the cost of all BAT components

BCT-2: lbs/year removed = 6,160
Cost of BCT-2* = $32,500 $/lb = 5.28 FAIL
*Includes the cost of all BAT components except the sulfide precipitation.

B. Continuous Type

BCT-1: lbs/year removed = 126,460
Cost of BCT-1* = $ 91,100 $/lb = 0.72 PASS
*Includes the cost of all BAT components

BCT-2 lbs/year removed = 134,268
Cost of BCT-2* = $119,000 $/lb = 0.88 PASS
*Includes the cost of all BAT components except the sulfide precipitation.

TABLE VIII-45

RESULTS OF BCT COST TEST
HYDROCHLORIC ACID PICKLING SUBCATEGORY

(Acid Regeneration System Continuous Pickling Lines Only)

A. Batch Type

BCT-1: lbs/year removed = 173,819
Cost of BCT-1* = $105,400 $/lb = 0.61 PASS
*Includes the cost of all BAT components

BCT-2 lbs/year removed = 183,707
Cost of BCT-2* = $140,600 $/lb = 0.76 PASS
*Includes the cost of all BAT components except the sulfide precipitation.

TABLE VIII-46

RESULTS OF BCT COST TEST
SULFURIC ACID PICKLING SUBDIVISION

A. Batch Type

BCT-1: lbs/year removed = 8,804
Cost of BCT-1* = $21,400 $/lb = 2.43 FAIL
*Includes the cost of all BAT components

BCT-2: lbs/year removed = 9,714
Cost of BCT-2* = $38,900 $/lb = 4.00 FAIL
*Includes the cost of all BAT components except sulfide precipitation.

B. Continuous Type

BCT-1: lbs/year removed = 28,556
Cost of BCT-1* = $44,100 $/lb = 1.54 FAIL
*Includes the cost of all BAT components.

BCT-2 lbs/year removed = 37,630
Cost of BCT-2* = $79,000 $/lb = 2.10 FAIL
*Includes the cost of all BAT components except sulfide precipitation.

TABLE VIII-47

NSPS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling-Sulfuric Acid	Model Size-TPD :	500
:	Batch	Oper. Days/Year:	260
:	Carbon & Specialty	Turns/Day :	3

C&TT Step	A(1)	B	Total
Investment \$ x 10^{-3}	119	1457	1576
Annual Cost \$ x 10^{-3}			
Capital	5.1	62.7	67.8
Depreciation	11.9	145.7	157.6
Operation & Maintenance	4.2	51.0	55.2
Crystal Disposal	-	27.8	23.8
Energy & Power	-	48.5	48.5
TOTAL	21.2	331.7	352.9
Less Credit			
Acid Recovery	-	19.3	19.3
NET ANNUAL COST	21.2	312.4	333.6

		Raw Waste Levels					NSPS
	Effluent Quality(2)	Conc	Rinse	FHS	Total(3)	Total(4)	Effluent Level
	Flow, gal/ton	20	330	710	1060	70	0
	Suspended Solids	870	420	70	195	2940	-
	Oil & Grease	150	65	4.5	26	395	-
	Dissolved Iron	56,000	54,000	130	2800	42,800	-
	pH, Units	<1-2	1-6	1.4-1.9	<1-6	<1-6	-
115	Arsenic	0.20	0.40	-	0.40	2.5	-
118	Cadmium	0.80	0.80	-	0.80	4.0	-
119	Chromium	240	5.1	-	18.5	95	-
120	Copper	3.7	1.2	-	1.3	6.7	-
122	Lead	0.80	0.30	-	0.50	1.6	-
124	Nickel	25	2.0	-	3.3	17	-
128	Zinc	75	21	-	24	120	-

---

(1) Step A costs and loads attributable to spent concentrates only.
(2) All values are in mg/l unless otherwise noted.
(3) Concentrations and flow values represent composite averages of concentrates, rinses, and FHS streams.
(4) Concentrations and flow values represent composite averages of concentrates, rinses after cascade rinse, and FHS blowdown stream.

KEY TO C&TT STEPS

A: Spent Acid Storage System B: Acid Recovery System

TABLE VIII-48

NSPS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Pickling-Sulfuric Acid	Model Size-TPD :	1980
:	Continuous	Oper. Days/Year :	260
:	Carbon & Specialty	Turns/Day :	3

C&TT Step	A(1)	B	Total
Investment $ x 10^{-3}	264	4034	4298
Annual Cost $ x 10^{-3}			
Capital	11.3	173.5	184.8
Depreciation	26.4	403.4	429.8
Operation & Maintenance	9.2	141.2	150.4
Crystal Disposal	-	128.7	128.7
Energy & Power	-	123.8	123.8
TOTAL	46.9	970.6	1017.5
Less Credit			
Acid Recovery	-	260.6	260.6
NET ANNUAL COST	46.9	710.0	756.9

		Raw Waste Levels					NSPS
Effluent Quality(2)		Conc	Rinse	FHS	Total(3)	Total(4)	Effluent Level
	Flow, gal/ton	20	220	130	370	55	0
	Suspended Solids	2600	120	70	236	1590	-
	Oil & Grease	18	12	4.5	10	65	-
	Dissolved Iron	45,000	6100	130	6100	41,100	-
	pH, Units	<1	2-6	1.4-1.9	<1-6	<1-6	-
115	Arsenic	0.20	0.07	-	0.10	0.35	-
118	Cadmium	0.50	0.10	-	0.10	0.60	-
119	Chromium	30	0.70	-	3.1	14	-
120	Copper	3.0	0.90	-	1.1	4.7	-
122	Lead	1.6	0.35	-	0.45	2.0	-
124	Nickel	21	4.6	-	6.0	26	-
128	Zinc	3.0	0.65	-	0.85	3.7	-

---

(1) Step A costs and loads attributable to spent concentrates only.
(2) All values are in mg/l unless otherwise noted.
(3) Concentrations and flow values represent composite averages of concentrates, rinses, and FHS streams.
(4) Concentrations and flow values represent composite averages of concentrates, rinses after cascade rinse, and FHS blowdown stream.

KEY TO C&TT STEPS

A: Spent Acid Storage System B: Acid Recovery System

TABLE VIII-49

NSPS, PSES AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Hydrochloric Acid Pickling	Model Size-TPD :	190
:	Batch Neutralization	Oper. Days/Year:	260
:	Carbon and Specialty	Turns/Day :	2

	Alternative No. 1										Alternative No. 2		
C&TT Steps	A	B	C	D	E	F	G	$H^{(1)}$	$I^{(1)}$	Total	$J^{(3)}$	$K^{(1)}$	Total (Incl. A-J)
Investment $\$ \times 10^{-3}$	55	76	79	60	116	57	26	72	91	632	29	72	733
Annual Cost $\$ \times 10^{-3}$													
Capital	2.4	3.3	3.4	2.6	5.0	2.5	1.1	3.1	3.9	27.2	1.2	3.1	31.5
Depreciation	5.5	7.6	7.9	6.0	11.6	5.7	2.6	7.2	9.1	63.2	2.9	7.2	73.3
Operation and Maintenance	1.9	2.7	2.8	2.1	4.1	2.0	0.9	2.5	3.2	22.1	1.0	2.5	25.6
Sludge Disposal	-	-	-	-	-	-	-	-	1.7	1 7	-	-	1.7
Energy and Power	-	$0.6^{(2)}$	-	-	0.4	0.3	0.3	0.1	0.1	1.2	0.1	0.2	1.5
Chemical Costs	-	-	-	-	9.1	0.3	-	-	-	10.2	0.2	-	10.4
Replacement Parts	-	-	10.5	-	-	-	-	-	-	10.5	-	-	10.5
TOTAL	9.8	$13.6^{(2)}$	24.6	10.7	30.2	10.8	4.9	12.9	18.0	136.1	5.4	13.0	1154.5

TABLE VIII-49
NSPS, PSES AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS
HYDROCHLORIC ACID PICKLING
PAGE 2

	Effluent Quality[(3)]	Raw Waste Level					Alt. No. 1 Effluent Level	PSES No. 1 Effluent Level
		Conc	Rinse	FHS	Total[(4)]	Total[(5)]		
	Flow, gal/ton	10	540	150	700	90	90	90
	Total Suspended Solids	450	90	370	155	1200	30	15
	Oil & Grease	44	33	66	40	310	10	5.0
	Dissolved Iron	57,000	2700	820	3100	24,000	1.0	1.0
	pH (Units)	<1-5	1-5	<1-3.7	<1-5	<1-5	6-9	6-9
23	Chloroform	0.03	0.01	0.10	0.03	0.25	0.01	0.01
114	Antimony	2.2	0.01	0.40	0.10	1.0	0.10	0.10
115	Arsenic	0.20	0.09	0.05	0.10	0.65	0.10	0.10
118	Cadmium	0.20	0.04	0.06	0.10	0.35	0.10	0.10
119	Chromium	13	0.35	0.35	0.50	4.1	0.10	0.10
120	Copper	13	0.60	0.80	0.80	6.4	0.10	0.10
122	Lead	310	18	0.30	18.35	145	0.10	0.10
124	Nickel	10	0.50	0.55	0.60	5.0	0.20	0.10
126	Silver	0.20	0.06	0.10	0.10	0.55	0.10	0.10
128	Zinc	15	146	0.65	113	880	0.10	0.10

---

(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.
(4) All values are once-through concentrations.
(5) Concentrations and flow values represent composite averages of concentrates, rinses after cascade rinse, and FHS blowdown streams.

KEY TO C&TT STEPS

A: Spent Acid Equalization System
B: FHS Recycle
C: Cascade Rinse
D: Equalization
E: Lime Addition
F: Polymer Addition

G: Aeration
H: Clarifier
I: Vacuum Filter
J: Sulfide Precipitation
K: Filtration

TABLE VIII-50

NSPS, PSES AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hydrochloric Acid Pickling
: Continuous-Neutralization
: Carbon and Specialty

Model Size-TPD : 2760
Oper. Days/Year: 312
Turns/Day : 3

C&TT Steps	Alternative No. 1										Alternative No. 2		
	A	B	C	D	E	F	G	H$^{(3)}$	I$^{(3)}$	Total	J$^{(3)}$	K$^{(3)}$	Total (Incl. A-I)
Investment $ x 10^{-3}	154	191	394	349	86	47	81	204	258	1764	24	153	1941
Annual Cost $ x 10^{-3}													
Capital	6.6	8.2	16.9	15.0	3.7	2.0	3.5	8.8	11.1	75.8	1.0	6.6	83.4
Depreciation	15.4	19.1	39.4	34.9	8.6	4.7	8.1	20.4	25.8	176.4	2.4	15.3	194.1
Operation and Maintenance	5.4	6.7	13.8	12.2	3.0	1.6	2.8	7.1	9.0	61.6	0.8	5.4	67.8
Sludge Disposal	-	-	-	-	-	-	-	-	94.2	94.2	-	-	94.2
Energy and Power$^{(1)}$	-	10.5$^{(2)}$	-	0.9	5.8	1.1	0.7	7.6	7.6	23.7	0.1	0.6	24.4
Chemical Costs	-	-	-	-	77.0	12.6	-	-	-	89.6	1.0	-	90.6
Replacement Parts	-	-	52.3	-	-	-	-	-	-	52.3	-	-	52.3
TOTAL	27.4	34.0$^{(2)}$	122.4	63.0	98.1	22.0	15.1	43.9	147.7	573.6	5.3	27.9	606.8

TABLE VIII-50
NSPS, PSES AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS
HYDROCHLORIC ACID PICKLING
PAGE 2

	Effluent Quality(4)	Raw Waste Level Conc	Raw Waste Level Rinse	Raw Waste Level FHS(4)	Raw Waste Level Total(5)	Total	Alt. No. 1 Effluent Level	Alt. No. 2 Effluent Level
	Flow, gal/ton	10	300	180	490	55	55	55
	Total Suspended Solids	450	90	370	200	1780	30	15
	Oil & Grease	44	33	66	45	400	10	5.0
	Dissolved Iron	57,000	2700	870	3100	28,000	1.0	1.0
	pH, Units	<1-5	1-5	<1-3.7	<1-5	<1-5	6-9	6-9
23	Chloroform	0.03	0.01	0.10	0.04	0.40	0.01	0.01
114	Antimony	2.2	0.01	0.40	0.20	1.8	0.10	0.10
115	Arsenic	0.20	0.09	0.05	0.10	0.70	0.10	0.10
118	Cadmium	0.20	0.04	0.06	0.10	0.45	0.10	0.10
119	Chromium	13	0.35	0.35	0.60	5.4	0.10	0.10
120	Copper	13	0.60	0.80	1.0	8.3	0.10	0.10
122	Lead	310	18	0.30	17.5	155	0.10	0.10
124	Nickel	10	0.50	0.55	0.70	6.4	0.20	0.10
126	Silver	0.20	0.06	0.10	0.10	0.70	0.10	0.10
128	Zinc	15	146	0.65	90	800	0.10	0.10

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(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is applied for existing process water needs.
(3) All values are in mg/l unless otherwise noted.
(4) All values are once-through concentrations.
(5) Concentrations and flow values represent composite averages of concentrates, rinses after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: Spent Acid Equalization System
B: FHS Recycle
C: Cascade Rinse
D: Equalization
E: Lime Addition

F: Polymer Addition
G: Aeration
H: Clarifier
I: Vacuum Filter
J: Sulfide Precipitation
K: Filtration

TABLE VIII-51

NSPS, PSES AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hydrochloric Acid Pickling
: Continuous-Acid Regeneration
: Carbon and Specialty

Model Size-TPD : 2760
Oper. Days/Year: 312
Turns/Day : 3

	Alternative No. 1										Alternative No. 2		
C&TT Step	A	B	C	D	E	F	G	H$^{(1)}$	I$^{(1)}$	Total	J$^{(1)}$	K$^{(1)}$	Total (Incl. A-I)
Investment $ x 10^{-3}	198	4814	191	406	77	46	94	237	300	6363	31	192	6586
Annual Cost $ x 10^{-3}													
Capital	8.5	207.0	8.2	17.5	3.3	2.0	4.0	10.2	12.9	273.6	1.3	8.3	283.2
Depreciation	19.8	481.4	19.1	40.6	7.7	4.6	9.4	23.7	30.0	636.3	3.1	19.2	658.6
Operation and Maintenance	6.9	168.5	6.7	14.2	2.7	1.6	3.3	8.3	10.5	227.7	1.1	6.7	230.5
Sludge Disposal	-	-	-	-	-	-	-	-	109.5	109.5	-	-	109.5
Energy and Power$^{(1)}$	-	307.3	10.5$^{(2)}$	1.0	5.5	1.0	0.9	8.8	8.9	333.4	0.2	1.0	334.6
Chemical Costs	-	-	-	-	72.0	12.0	-	-	-	84.0	1.5	-	85.5
Replacement Parts	-	52.3	-	-	-	-	-	-	-	52.3	-	-	52.3
TOTAL	35.2	1216.5	34.0$^{(2)}$	73.3	91.2	21.2	17.6	51.0	171.8	1716.8	7.2	35.2	1754.2
Less Credits													
Acid Recovery		2304.6								2304.6			2304.6
Iron Oxide Recovery		1543.6								1543.6			1543.6
Net Annual Cost	35.2	-2631.7	34.0$^{(2)}$	73.3	91.2	21.2	17.6	51.0	171.8	-2131.4	7.2	35.2	-2094.0

TABLE VIII-51
NSPS, PSES AND PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS
HYDROCHLORIC ACID PICKLING
PAGE 2

Effluent Quality(3)		w Waste Level							
		Conc	Rinse	FHS	AVS	Total(4)	Total(5)	Alt. No. 1 Effluent Level	Alt. No. 2 Effluent Level
	Flow, gal/ton	10	300	180	120	610	70	70	70
	Total Suspended Solids	450	90	370	90	180	1560	30	15
	Oil & Grease	44	33	66	2	37	320	10	5.0
	Dissolved Iron	57,000	2700	820	650	2630	23,000	1.0	1.0
	pH (Units)	<1-5	1-5	<1-3.7	<1-7.6	<1-7.6	<1-7.6	6-9	6-9
23	Chloroform	0.03	0.01	0.10	0.02	0.04	0.35	0.01	0.01
114	Antimony	2.2	0.01	0.40	0.20	0.20	1.7	0.10	0.10
115	Arsenic	0.20	0.09	0.05	0.02	0.10	0.60	0.10	0.10
118	Cadmium	0.20	0.04	0.06	-	0.10	0.35	0.10	0.10
119	Chromium	13	0.35	0.35	0.02	0.50	4.3	0.10	0.10
120	Copper	13	0.60	0.80	0.80	0.90	7.9	0.10	0.10
122	Lead	310	18	0.30	1.0	14	125	0.10	0.10
124	Nickel	10	0.50	0.55	0.35	0.65	5.6	0.20	0.10
126	Silver	0.20	0.06	0.10	0.10	0.10	0.70	0.10	0.10
128	Zinc	15	146	0.65	1.0	73	630	0.10	0.10

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(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is applied for existing process water needs.
(3) All values are in mg/l unless otherwise noted.
(4) All values are once-through concentrations.
(5) Concentrations and flow values represent composite averages of concentrates, rinses after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: Spent Acid Equalization System
B: Acid Regeneration System
C: FHS Recycle, Cascade Rinse
D: Equalization
E: Lime Addition

F: Polymer Addition
G: Aeration
H: Clarifier
I: Vacuum Filter
J: Sulfide Precipitation
K: Filtration

TABLE VIII-52

NSPS & PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Combination Acid Pickling
: Batch
: Carbon-Specialty

Model Size-TPD : 200
Oper. Days/Year: 260
Turns/Day : 2

	Alternative No. 1								Alternative No. 2		
C&TT Steps	A	B	C	D	E	F(3)	G(3)	Total	H	I	Total (Includes A-G)
Investment $ x 10^{-3}	63	82	41	79	39	49	62	415	34	84	533
Annual Cost $ x 10^{-3}											
Capital	2.7	3.5	1.8	3.4	1.7	2.1	2.7	17.8	1.5	3.6	22.9
Depreciation	6.3	8.2	4.1	7.9	3.9	4.9	6.2	41.5	3.4	8.4	53.3
Operation and Maintenance	2.2	2.9	1.4	2.8	1.4	1.7	2.2	14.5	1.2	2.9	18.7
Sludge Disposal	-	-	-	-	-	-	1.2	1.2	-	-	1.2
Energy and Power(1)	0.7(2)	-	-	0.3	0.2	0.1	0.1	0.7	0.1	0.1	0.9
Chemical Costs	-	-	-	6.2	0.2	-	-	6.4	0.1	-	6.5
Replacement Parts	-	10.8	-	-	-	-	-	10.8	-	-	10.8
TOTAL	11.2(2)	25.4	7.3	20.6	7.4	8.8	12.4	92.9	6.3	15.0	114.3

TABLE VIII-52
NSPS & PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS
COMBINATION ACID PICKLING
PAGE 2

	Effluent Quality$^{(4)}$	Raw Waste Level					Alt. No. 1 Effluent Level	Alt. No. 2 Effluent Level
		Conc	Rinse	FHS$^{(4)}$	Total$^{(5)}$	Total$^{(6)}$		
	Flow, gal/ton	15	200	1140	1355	45	45	45
	Suspended Solids	130	50	25	30	900	30	15
	Oil & Grease	0.40	4.6	0.30	1.0	28	10	5.0
	Dissolved Iron	19,000	230	50	290	8620	1.0	1.0
	Fluoride	3900	430	1800	1620	48,800	15	45
	pH, Units	<1-2.3	2-4	1.5-2.0	<1-4	<1-4	6-9	6-9
115	Arsenic	-	0.10	-	0.10	0.10	0.10	0.10
119	Chromium	4300	48	2.4	55	1700	0.10	0.10
120	Copper	230	1.3	-	17	82	0.10	0.10
122	Lead	2.7	0.07	-	0.25	1.2	0.10	0.10
124	Nickel	5800	53	3.3	75	2250	0.20	0.10
128	Zinc	1.7	1.0	0.30	0.60	18	0.10	0.10

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(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is applied for existing process water needs.
(3) All values are in mg/l unless otherwise noted.
(4) All values are once-through concentrations.
(5) All values are once-through concentrations.
(6) Concentrations and flow values represent concentrates, rinses after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: FHS Recycle	E: Polymer Addition
B: Cascade Rinse	F: Clarifier
C: Equalization Tank	G: Vacuum Filter
D: Lime Addition	H: Sulfide Precipitation
	I: Filtration

TABLE VIII-53

NSPS & PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Combination Acid Pickling
: Continuous
: Carbon-Specialty

Model Size-TPD : 500
Oper. Days/Year: 320
Turns/Day : 3

	Alternative No. 1									Alternative No. 2	
C&TT Steps	A	B	C	D	E	$F^{(3)}$	$G^{(3)}$	Total	H	I	Total (Includes A-G)
Investment $ x 10^{-3}	59	142	96	102	52	84	81	616	34	107	757
Annual Cost $ x 10^{-3}											
Capital	2.5	6.1	4.1	4.4	2.2	3.6	3.5	26.5	1.5	4.6	32.6
Depreciation	5.9	14.2	9.6	10.2	5.2	8.4	8.1	61.6	3.4	10.7	75.7
Operation and Maintenance	2.1	5.0	3.4	3.6	1.8	2.9	2.8	21.6	1.2	3.7	26.5
Sludge Disposal (1)	-	-	-	-	-	-	1.3	1.3	-	-	1.3
Energy and Power	1.4(2)	-	-	0.5	0.3	0.3	0.6	1.7	0.2	0.3	2.2
Chemical Costs	-	-	-	8.2	1.2	-	-	9.4	0.3	-	9.7
Replacement Parts	-	18.8	-	-	-	-	-	18.8	-	-	18.8
TOTAL	10.5(2)	44.1	17.1	26.9	10.7	15.2	16.3	140.9	6.6	19.3	166.8

TABLE VIII-53
NSPS & PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS
COMBINATION ACID PICKLING
PAGE 2

	Effluent Quality$^{(4)}$	Raw Waste Levels Conc	 Rinse	 FHS$^{(4)}$	 Total$^{(5)}$	 Total$^{(6)}$	Alt. No. 1 Effluent Level	Alt. No. 2 Effluent Level
	Flow, gal/ton	15	500	720	1235	90	90	90
	Suspended Solids	200	180	25	90	1230	30	15
	Oil & Grease	3.5	3.3	0.30	1.6	21	10	5.0
	Dissolved Iron	23,000	155	2.4	345	4700	1.0	1.0
	Fluoride	10,000	69	50	180	2450	15	15
	pH (Units)	1.5	2.5-8	1.5-2.0	1.5-8	1.5-8	6-9	6-9
4	Benzene	-	0.05	**	0.05	0.05	0.05	0.025
115	Arsenic	-	0.01	-	0.01	0.01	0.01	0.01
119	Chromium	3300	25	8.3	55	755	0.10	0.10
120	Copper	100	0.27	0.07	1.4	19	0.10	0.10
122	Lead	1.2	-	-	1.2	1.2	0.10	0.10
124	Nickel	3300	15	1800	1100	15,000	0.20	0.10
128	Zinc	4.1	0.40	0.30	0.40	5.3	0.10	0.10

** Value is less than 0.010 mg/l.
(1) Costs are all power unless otherwise noted.
(2) Total does not include power, because a credit is supplied for existing process water requirements.
(3) Treatment components are used in tandem.
(4) All values are are in mg/l unless otherwise noted.
(5) All values are once-through concentrations.
(6) Concentrations and flow values represent composite averages of concentrates, rinses after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: FHS Recycle
B: Cascade Rinse
C: Equalization Tank
D: Lime Addition
E: Polymer Addition
F: Clarifier
G: Vacuum Filter
H: Sulfide Precipitation
I: Filter

TABLE VIII-54

PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Sulfuric Acid
: Batch
: Neutralization

Model Size-TPD : 500
Oper. Days/Year: 260
Turns/Day : 3

	Alternative No. 1									Alternative No. 2		
C&TT Steps	A	B	C	D	E	F	G(1)	H(1)	Total	I(1)	J(1)	Total (Incl. A-H)
Investment $ x 10^{-3}	119	128	114	41	36	74	90	60	662	34	118	814
Annual Cost $ x 10^{-3}												
Capital	5.1	5.5	4.9	1.8	1.5	3.2	3.9	2.6	28.5	1.5	5.1	35.0
Depreciation	11.9	12.8	11.4	4.1	3.6	7.4	9.0	6.0	66.2	3.4	11.8	81.4
Operation and Maintenance	4.2	4.5	4.0	1.4	1.3	2.6	3.2	2.1	23.2	1.2	4.1	28.5
Sludge Disposal	-	-	-	-	-	-	-	4.1	4.1	-	-	4.1
Energy and Power(1)	-	0.9(2)	-	0.2	0.4	0.2	0.2	1.1	2.1	0.2	1.8	4.1
Chemical Costs	-	1.2	-	-	16.2	2.6	-	-	20.0	0.7	-	20.7
Replacement Parts	-	-	15.2	-	-	-	-	-	15.2	-	-	15.2
TOTAL	21.2	24.0(2)	35.5	7.5	23.0	16.0	16.3	15.9	159.3	7.0	22.8	189.0

TABLE VIII-54
PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS
PICKLING-SULFURIC ACID
PAGE 2

Effluent Quality(3)		Raw Waste Level					PSES No. 1 Effluent Level	PSES No. 2 Effluent Level
		Conc	Rinse	FHS	Total(4)	Total(5)		
	Flow, gal/ton	20	330	710	1060	70	70	70
	Suspended Solids	870	420	70	195	2940	30	15
	Oil & Grease	150	65	4.5	26	400	10	5.0
	Dissolved Iron	56,000	5400	130	2800	42,800	1.0	1.0
	pH, Units	<1	1-6	1.4-1.9	<1-6	1-6	6-9	6-9
115	Arsenic	0.20	0.40	-	0.40	1.9	0.10	0.10
118	Cadmium	0.80	0.80	-	0.80	4.0	0.10	0.10
119	Chromium	240	5.1	-	18.5	93	0.10	0.10
120	Copper	3.7	1.2	-	1.3	6.7	0.10	0.10
122	Lead	0.80	0.30	-	0.50	1.6	0.10	0.10
124	Nickel	25	2.0	-	3.3	16.5	0.20	0.10
128	Zinc	75	21	-	24	120	0.10	0.10

---

(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is supplied for existing process water needs.
(3) All values are in mg/l unless otherwise noted.
(4) All values are once-through concentrations.
(5) Concentrations and flow values represent concentrates, rinses after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: Spent Acid Equalization System
B: FHS Recycle
C: Cascade Rinse
D: Equalization
E: Lime Addition

F: Polymer Addition, Aeration
G: Clarifier
H: Vacuum Filter
I: Sulfide Precipitation
J: Filter

TABLE VIII-55

PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Pickling-Sulfuric Acid
: Continuous
: Neutralization
: Carbon & Speciality

Model Size-TPD : 1980
Oper. Days/Year: 260
Turns/Day : 3

C&TT Steps	Alternative No. 1									Alternative No. 2		
	A	B	C	D	E	F	G(1)	H(1)	Total	I(1)	J(1)	Total (Incl. A-H)
Investment $ x 10^{-3}	264	171	323	287	68	105	167	213	1598	64	157	1819
Annual Cost $ x 10^{-3}												
Capital	11.3	7.3	13.9	12.3	2.9	4.5	7.2	9.2	68.6	2.8	6.7	78.1
Depreciation	26.4	17.1	32.3	28.7	6.8	10.5	16.7	21.3	159.8	6.4	15.7	181.9
Operation and Maintenance	9.2	6.0	11.3	10.0	2.4	3.7	5.8	7.5	55.9	2.2	5.5	63.6
Sludge Disposal	-	-	-	-	-	-	-	15.3	15.3	-	-	15.3
Energy and Power(1)	-	2.4(2)	-	0.3	1.6	0.4	1.0	5.1	8.4	0.3	2.2	10.9
Chemical Costs	-	2.0	-	-	104.4	10.4	-	-	116.8	1.4	-	118.2
Replacement Parts	-	-	42.8	-	-	-	-		42.8	-	-	42.8
TOTAL	46.9	32.4(2)	100.3	51.3	118.1	29.5	30.7	58.4	467.6	13.1	30.1	510.8

TABLE VIII-55
PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS
PICKLING-SULFURIC ACID
PAGE 2

		Raw Waste Level						
	Effluent Quality(3)	Conc	Rinse	FHS	Total(4)	Total(5)	PSES No. 1 Effluent Level	PSES No. 2 Effluent Level
	Flow, gal/ton	20	220	130	370	55	55	55
	Suspended Solids	2600	120	70	236	1590	30	15
	Oil & Grease	18	12	4.5	10	65	10	5.0
	Dissolved Iron	45,000	6100	130	6100	41,000	1.0	1.0
	pH, Units	<1	2-6	1.4-1.7	<1-6	<1-6	6-9	6-9
115	Arsenic	0.20	0.07	-	0.10	0.35	0.10	0.10
118	Cadmium	0.50	0.10	-	0.10	0.60	0.10	0.10
119	Chromium	30	0.70	-	3.1	14	0.10	0.10
120	Copper	3.0	0.90	-	1.1	4.7	0.10	0.10
122	Lead	1.6	0.35	-	0.45	2.0	0.10	0.10
124	Nickel	21	4.6	-	6.0	26	0.20	0.10
128	Zinc	3.0	0.65	-	0.85	3.7	0.10	0.10

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(1) Treatment components are used in tandem.
(2) Total cost does not include power, because a credit is supplied for existing process water needs.
(3) All values are in mg/l unless otherwise noted.
(4) All values are once-through concentrations.
(5) Concentrations and flow values represent concentrates, rinses after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: Spent Acid Equalization System
B: FHS Recycle
C: Cascade Rinse
D: Equalization
E: Lime Addition
F: Polymer Addition, Aeration
G: Clarifier
H: Vacuum Filter
I: Sulfide Precipitation
J: Filter

TABLE VIII-56

PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Combination Acid Pickling	Model Size-TPD :	200
:	Batch	Oper. Days/Year:	260
:	Carbon and Specialty	Turns/Day :	2

	Alternative No. 1								2-Steps A to E of Alt. 1 plus:			
C&TT Steps	A	B	C	D	E	F$^{(3)}$	G$^{(3)}$	Total	H	I$^{(3)}$	J$^{(3)}$	Total
Investment $ x 10^{-3}	63	69	68	85	39	69	79	472	23	25	97	469
Annual Cost $ x 10^{-3}												
Capital	2.7	3.0	2.9	3.7	1.7	3.0	3.4	20.3	1.0	1.1	4.2	20.2
Depreciation	6.3	6.9	6.8	8.5	3.9	6.9	7.9	47.2	2.3	2.5	9.7	46.9
Operation and Maintenance	2.2	2.4	2.4	3.0	1.4	2.4	2.8	16.5	0.8	0.9	3.4	16.4
Sludge Disposal	-	-	-	-	-	-	1.7	1.7	1.7	-	-	1.7
Energy and Power$^{(1)}$	0.7$^{(2)}$	-	0.2	0.3	0.1	0.2	0.3	1.8	-	0.1	0.2	1.6
Chemical Costs	-	-	-	6.1	0.5	-	-	6.6	-	0.1	-	6.6
Replacement Parts	-	9.1	-	-	-	-	-	9.1	-	-	-	9.1
TOTAL	11.2$^{(2)}$	21.4	12.3	21.6	7.6	12.5	16.1	103.2	4.1	4.7	17.5	102.5

TABLE VIII-56
PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS
COMBINATION ACID PICKLING
PAGE 2

Effluent Quality(3)		Raw Waste Level					PSES No. 1 Effluent Level	PSES No. 2 Effluent Level
		Conc	Rinse	FHS	Total(5)	Total(6)		
	Flow, gal/ton	15	520	1140	1675	105	105	105
	Total Suspended Solids	130	50	25	34	540	30	15
	Oil & Grease	0.40	4.6	0.30	1.6	26	10	5.0
	Dissolved Iron	19,000	230	50	275	4400	1.0	1.0
	Fluoride	3900	430	1800	1400	22,200	15	15
	pH (Units)	<1-2.3	2-4	1.5-2.0	<1-4	<1-4	6-9	6-9
115	Arsenic	-	0.10	-	0.10	0.10	0.10	0.10
119	Chromium	4300	48	2.4	55	880	0.10	0.10
120	Copper	230	1.3	-	7.7	39	0.10	0.10
122	Lead	2.7	0.07	-	0.10	0.75	0.10	0.10
124	Nickel	5800	53	3.3	71	1130	0.20	0.10
128	Zinc	17	1.0	0.30	0.70	11	0.10	0.10

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(1) All costs are power unless otherwise noted.
(2) Total cost does not include power, because a credit is applied for existing process water requirements.
(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.
(5) Values are once-through concentrations.
(6) Concentration and flow values represent composite averages of concentrate, rinse after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: FHS Recycle
B: Cascade Rinse
C: Equalization
D: Lime Addition
E: Polymer Addition
F: Clarifier
G: Vacuum Filter
H: Settling Basin
I: Sulfide Precipitation
J: Filter

TABLE VIII-57

PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Combination Acid Pickling	Model Size-TPD :	500
:	Continuous	Oper. Days/Year:	320
:	Carbon and Specialty	Turns/Day :	3

C&TT Steps	Alternative No. 1								2-Steps A to E of Alt. 1 plus:			
	A	B	C	D	E	F(3)	G(3)	Total	H	I(3)	J(3)	Total
Investment $ x 10^{-3}	69	142	225	160	58	135	203	982	105	41	191	981
Annual Cost $ x 10^{-3}												
Capital	2.5	6.1	9.7	6.9	2.5	5.8	8.7	42.2	4.5	1.8	8.2	42.2
Depreciation	5.9	14.2	22.5	16.0	5.8	13.5	20.3	98.2	10.5	4.1	19.1	98.1
Operation and Maintenance	2.1	5.0	7.9	5.6	2.0	4.7	7.1	34.4	3.7	1.4	6.7	34.4
Sludge Disposal	-	-	-	-	-	-	4.4	4.4	-	-	-	-
Energy and Power(1)	1.4(2)	-	0.3	1.0	0.7	0.4	4.2	6.6	-	0.2	0.9	3.1
Chemical Costs	-	-	-	27.2	4.1	-	-	31.3	-	0.9	-	32.2
Replacement Parts	-	18.8	-	-	-	-	-	18.8	-	-	-	18.8
TOTAL	10.5(2)	44.1	40.4	56.7	15.1	24.4	44.7	235.9	18.7	8.4	34.9	228.8

TABLE VIII-57
PSES MODEL COST DATA: BASIS 7/1/78 DOLLARS
COMBINATION ACID PICKLING
PAGE 2

		Raw Waste Level						
	Effluent Quality$^{(4)}$	Conc	Rinse	FHS$^{(4)}$	Total$^{(5)}$	Total$^{(6)}$	PSES No. 1 Effluent Level	PSES No. 2 Effluent Level
	Flow, gal/ton	15	1800	720	2535	335	335	335
	Total Suspended Solids	200	180	25	135	1030	30	15
	Oil & Grease	3.5	3.3	0.30	2.4	18.5	10	5.0
	Dissolved Iron	23,000	155	2.4	250	1870	1.0	1.0
	Fluoride	10,000	69	50	122	930	15	15
	pH, Units	1-5	2.5-8	1.5-2.0	1.5-8	1.5-8	6-9	6-9
004	Benzene	-	0.05	**	0.05	0.05	0.05	0.025
115	Arsenic	-	0.01	-	0.01	0.01	0.01	0.01
119	Chromium	3300	25	8.3	40	300	0.10	0.10
120	Copper	100	0.27	0.07	0.80	6.1	0.10	0.10
122	Lead	1.2	-	-	1.2	1.2	0.10	0.10
124	Nickel	3300	15	1800	540	4100	0.20	0.10
128	Zinc	4.1	0.40	0.30	0.40	3.0	0.10	0.10

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(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is applied for existing process water needs.
(3) Treatment components are used in tandem.
(4) All values are in mg/l unless otherwise noted.
(5) All values are once-through concentrations.
(6) Concentrations and flow values represent composite averages of concentrates, rinses after cascade rinse, and fume hood scrubber blowdown streams.

KEY TO C&TT STEPS

A: FHS Recycle
B: Cascade Rinse
C: Equalization
D: Lime Addition
E: Polymer Addition

F: Clarifier
G: Vacuum Filter
H: Settling Basin
I: Sulfide Precipitation
J: Filter

TABLE VIII-58

BPT INVESTMENT AND ANNUAL COSTS FOR THE ACID PICKLING SUBCATEGORY

		BPT Costs ($\$ \times 10^{-6}$)			
		Investment			Total
Subdivision	Segment	In Place	Required	Total	Annual
Sulfuric					
	Batch Neutralization	24.18	10.55	34.73	10.32
	Batch Acid Recovery	3.82	60.97	64.79	17.63
	Continuous Neutralization	17.97	10.85	28.82	7.56
	Continuous Acid Recovery	2.34	6.96	9.30	12.70
		48.31	89.33	137.64	48.21
Hydrochloric					
	Batch Neutralization*	1.29	3.48	4.77	1.75
	Continuous Neutralization	36.38	25.98	62.31	25.11
	Continuous Acid Regeneration*	18.72	29.80	48.52	-19.80
		63.47	60.94	124.41	7.06
Combination					
	Batch	10.10	11.48	21.58	7.00
	Continuous	16.59	8.73	25.32	5.89
		26.69	20.21	46.90	12.89
	Total of Subcategory	138.47	170.48	308.95	68.16

---

* : The costs of confidential plants are not included in the investment cost totals for this segment.

Note: All investment cost totals presented in this table include the costs of confidential plants unless otherwise noted.

TABLE VIII-59

BAT INVESTMENT AND ANNUAL COSTS FOR THE ACID PICKLING SUBCATEGORY

		BAT Costs ($ x 10^{-6})					
		Total Investment			Total Annual		
Subdivision	Segment	BAT-1	BAT-2	BAT-3	BAT-1	BAT-2	BAT-3
Sulfuric							
	Batch Neutralization	6.73	15.69	84.72	2.09	3.84	17.50
	Continuous Neutralization	6.14	10.34	52.29	1.91	2.73	11.31
		12.87	26.03	137.01	4.00	6.57	28.81
Hydrochloric							
	Batch Neutralization	0.44	1.15	9.89	0.14	0.27	1.90
	Continuous Neutralization	9.08	14.57	72.20	2.82	3.85	17.89
	Continuous Acid Neutralization	3.05	5.06	25.89	0.95	1.33	6.74
		12.57	20.78	107.98	3.91	5.45	26.53
Combination							
	Batch	3.45	9.55	77.95	1.07	2.18	15.02
	Continuous	2.70	7.11	50.41	0.84	1.66	11.65
		6.15	16.66	128.36	1.91	3.84	26.67
	Total of Subcategory	31.59	63.47	373.35	9.82	15.86	82.01

Note: Sulfuric acid recovery operations achieve zero discharge at BPT, therefore no additional costs are incurred at BAT.

TABLE VIII-60

ENERGY REQUIREMENTS IN THE ACID PICKLING SUBCATEGORY

		Energy Requirements (kw-hr/year) x 10^{-6}										
		Subcategory Basis				Treatment Model Basis						
Subdivision	Segment	BPT	BAT-1	BAT-2	BAT-3	BCT	NSPS-1	NSPS-2	PSES-1	PSES-2	PSNS-1	PSNS-1
Sulfuric												
	Batch Neutralization	16.99	-	4.72	56.64	-	1.94(1)	N/A	0.08	0.16	1.94(1)	N/A
	Batch Acid Recovery	117.65	-	-	-	-			-	-		
	Continuous Neutralization	14.97	-	1.90	44.46	-	4.95(2)	N/A	0.43	0.53	4.95(2)	N/A
	Continuous Acid Recovery	84.34		-	-	-			-	-		
		233.95	-	6.62	101.10							
Hydrochloric												
	Batch Neutralization	2.44	-	0.08	3.39	-	0.05	0.06	0.05	0.06	0.05	0.06
	Continuous Neutralization	46.25	-	0.87	153.26	0.02	0.95	0.98	0.95	0.98	0.95	0.98
	Continuous Acid Regeneration	129.56		0.43	68.87	0.04	13.34	13.38	13.34	13.38	13.34	13.38
		178.25	-	1.38	225.52							
Combination												
	Batch	4.60	-	0.60	27.60	-	0.03	0.04	0.07	0.06	0.03	0.04
	Continuous	6.08		0.84	92.95	-	0.07	0.09	0.26	0.12	0.07	0.09
		10.68	-	1.44	120.55							
	Total for Subcategory	422.88	-	9.44	447.17							

---

1 : The energy requirements listed refers to all batch sulfuric operations.
2 : The energy requirements listed refers to all continuous sulfuric operations.
N/A: Not applicable.

Note: BAT and BCT energy requirements listed represent those energy units required in addition to BPT.

TABLE VIII-61

SOLID WASTE GENERATION SUMMARY(1)
ACID PICKLING SUBCATEGORY

Subdivision	lbs/ton(2)	lbs/day(3)
Sulfuric Acid		
Batch Acid Recovery		
BPT	49.54	24,770
Batch Neutralization		
BPT	40.02	20,010
BAT 1*	0.206	103.2
BAT 2*	0.220	109.9
BAT 3*	0.234	116.8
Continuous Acid Recovery		
BPT	36.611	72,490
Continuous Neutralization		
BPT	29.252	57,919
BAT 1*	0.141	278.9
BAT 2*	0.151	299.5
BAT 3*	0.162	321.2
Hydrochloric Acid		
Batch Neutralization		
BPT	28.196	535.7
BAT 1*	0.330	62.62
BAT 2*	0.347	65.87
BAT 3*	0.365	69.30
Continuous Neutralization		
BPT	20.245	55,875
BAT 1*	0.187	515.9
BAT 2*	0.197	544.8
BAT 3*	0.208	575.2
Continuous Acid Recovery		
BPT	12.357	34,106
BAT 1*	0.253	697.5
BAT 2*	0.266	734.2
BAT 3*	0.280	773.0

TABLE VIII-61
SOLID WASTE GENERATION SUMMARY(1)
ACID PICKLING SUBCATEGORY
PAGE 2

Subdivision	lbs/ton(2)	lbs/day(3)
Combination Acid		
Batch		
BPT	7.419	1,484
BAT 1*	0.147	29.33
BAT 2*	0.160	31.99
BAT 3*	0.182	36.33
Continuous		
BPT	8.671	4335
BAT 1*	0.510	255.0
BAT 2*	0.552	276.2
BAT 3*	0.622	310.8

---

(1) Includes solids and metal calculated on a dry basis.
(2) Pounds of solid waste per ton of production based on treatment model.
(3) Pounds of solid waste per day based on treatment model.
*: Loads over and above BPT levels.

ACID PICKLING SUBCATEGORY

SECTION IX

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

Introduction

The Agency is proposing BPT limitations which are the same as those originally promulgated in 1976. Additional limitations are being proposed in the sulfuric acid subdivision for batch neutralization operations. The 1976 regulation limited all batch sulfuric operations at zero discharge. However, reanalysis of the data for this segment indicates batch neutralization and batch acid recovery operations should be limited separately. A review of the treatment processes and effluent limitations associated with the acid pickling subcategory follows.

Identification of BPT

The BPT model treatment systems described in this section are identical to the systems used to develop the originally promulgated BPT limitations. There are three basic modes of treatment in use in the acid pickling subcategory. A description of each treatment mode follows.

1. Neutralization

   Neutralization of acid pickling wastewaters is currently carried out for sulfuric, hydrochloric, and combination acid pickling operations. The basic treatment system combines spent pickle liquor (which has been equalized), rinsewater, and fume scrubber blowdown in a second equalization basin. An oil separator is included in the combination acid pickling model. Lime and polymer are then added to the wastewaters in a mixing tank. The lime neutralizes the acidic waste, while the polymer serves as a flocculant. In the sulfuric and hydrochloric acid pickling BPT model treatment systems, aeration is also provided at this point. The pollutants which have been separated out must be removed. The sulfuric acid pickling model includes a settling basin to accomplish this. Separation is achieved with a thickener and vacuum filter in the hydrochloric acid pickling subdivision, while a clarifier and a vacuum filter are used in the combination acid pickling subdivision. The filtrates from the vacuum filters are returned to the respective thickener and clarifier inlets.

2. Acid Recovery

   Acid recovery is practiced in the sulfuric acid pickling subdivision. A spent acid storage system and the acid recovery system, including storage for the recovered acid and by-product, are the only components necessary for acid recovery. This method crystallizes the iron salts out of the pickling wastewater. The sulfuric acid which remains is then strengthened to its original concentration, so that it may be reused. This treatment model achieves zero discharge.

3. Acid Regeneration

Acid regeneration is practiced in the hydrochloric acid pickling subdivision as an alternative to neutralizing the spent pickle liquor. In this method, the spent pickle liquor is regenerated. Ferrous chloride is hydrolyzed to an iron oxide by-product and HCl gas. The gas is then absorbed to reform hydrochloric acid. This process can generate absorber vent scrubber wastewater, which is combined with the rinsewater and fume scrubber blowdown. The three sources of wastewater are then neutralized as described previously.

The BPT model treatment systems described above are illustrated in Figures IX-1 through IX-5. As noted in Section VII, each component included in the model treatment systems is in use at a number of acid pickling operations.

The proposed BPT limitations do not require the use of the model treatment systems presented in this section. Any systems which achieve the limitations are acceptable. The proposed BPT effluent limitations, which represent 30-day average values are presented in Table IX-1. The proposed maximum daily effluent limitations are three times the average values.

Justification of BPT

Tables IX-2 through IX-4 present the justification of the BPT effluent limitations originally promulgated in March 1976. All of these limitations are being reproposed. In addition, new limitations are proposed in the sulfuric acid subdivision for batch neutralization operations. The 1976 BPT limitation for all batch sulfuric operations was zero discharge. However, only acid recovery operations achieve zero discharge. Therefore, a neutralization model treatment system was developed reflecting treatment components, flows, and pollutant concentrations of those sulfuric batch neutralization plants currently in operation. Refer to Tables X-1 and X-2 for the derivations of the flow values used to specify the sulfuric acid batch neutralization model.

Tables IX-2 through IX-4 present sampled plant effluent data which support the proposed BPT limitations. All of the plants listed achieve one or more of the effluent limitations, except for Plant AA-2, in the hydrochloric subdivision. No specific chemical treatment is practiced at this plant, because all effluents are disposed of by deep well injection. Data from the other sampled plants demonstrate that the proposed BPT effluent limitations are achievable.

Total Metals

In the combination acid pickling subdivision, limitations for chromium and nickel were promulgated on a dissolved basis in 1976. The Agency is presently proposing limitations for these toxic metal pollutants on a total metal basis. The total metal more accurately reflects the true pollutant load characteristics of this waste source. In addition, total chromium and total nickel are included in the toxic pollutant list. No change in the limitations for these metals is being proposed, since the proposed limitations for the total metals are justified in this subcategory. Fluoride is also limited at BPT in the combination acid pickling subdivision. However, these limitations only apply when hydrofluoric acid is used in the pickling process.

TABLE IX-1

BPT EFFLUENT LIMITATIONS - ACID PICKLING SUBCATEGORY

Operation	Discharge Flow Basis (GPT)	TSS	Oil and Grease(1)	Dissolved Iron	Chromium	Fluoride(2)	Nickel
SULFURIC ACID							
Batch Neutralization	360	0.0751	0.0150	0.00150	-	-	-
Batch Acid Recovery		No discharge of process wastewater pollutants					
Continuous Neutralization (with spent pickle liquor)	250	0.0521	0.0104	0.00104	-	-	-
Continuous Neutralization (without spent pickle liquor)	225	0.0469	0.00938	0.000938	-	-	-
Continuous Acid Recovery		No discharge of process wastewater pollutants					
HYDROCHLORIC ACID							
Batch Neutralization with scrubber	280	0.0584	0.0117	0.00117	-	-	-
Batch Neutralization without scrubber	230	0.0480	0.00960	0.000960	-	-	-
Continuous Neutralization with scrubber	280	0.0584	0.0117	0.00117	-	-	-
Continuous Neutralization without scrubber	230	0.0480	0.00960	0.000960	-	-	-
Continuous Acid Regeneration with scrubber	450	0.0938	0.0187	0.00187	-	-	-
Continuous Acid Regeneration without scrubber	400	0.0834	0.0166	0.00166	-	-	-
COMBINATION ACID							
Batch Pipe and Tube	700	0.0730	0.0292	0.00292	0.00146	0.0438	0.000730
Batch Other	200	0.0209	0.00834	0.000834	0.000417	0.0125	0.000209
Continuous	1000	0.104	0.0417	0.00417	0.00209	0.0626	0.00104

---

(1) This load is allowed only when these wastes are treated in combination with cold rolling mill wastes.

(2) This load is allowed only when hydrofluoric acid is used.

TABLE IX-2

JUSTIFICATION OF BPT EFFLUENT LIMITATIONS SULFURIC ACID PICKLING SUBDIVISION

	Effluent Limitations (kg/kkg)				
	TSS	O&G(1)	Dissolved Iron	pH (Units)	C&TT
Proposed BPT Effluent Limitations					
Batch-All Operations	0	0	0	-	
Continuous-Neutralization					
(with spent pickle liquor)	0.0521	0.0104	0.00104	6-9	
(without spent pickle liquor)	0.0469	0.00938	0.000938	6-9	
Continuous-Acid Recovery	0	0	0	-	
Actual Effluent Loads					
Batch-Neutralization					
I-2a (08560)	0.023	0.0068	0.0018	6.7	SL,NL
I-2b (08560)	0.029	*	0.00041	6.7	SL,NL
R-2 (0240B)	0.000057	Neg	Neg	*	SL,E
S-2 (0256G)(4)	0	0	0	-	100% Recycle
090 (0476A)	0.000066	0.00400	0.00012	6.6-9.0	E,A,NL,SC,Ski,FLP
091 (0612)	0.00066	0.00060	0.00093	7.5-8.3	E,CRCC,NL,FLP,T,VF
096 (0112I)	0.0028	0.0026	0.003	7.3	A,NL,F,T
Batch-Acid Recovery					
O-2 (0590)	0	0	0	-	AR
Q-2 (0894)	0	0	0	-	AR
Continuous-Neutralization					
QQ-2 (0584E)(2)	0.00015	0.000056	Neg	7.5	CRCC,EB,NL,SC,SL
SS-2 (0112A)(2)	0.014	0.00022	0.00034	7.7	NL,A,T,SL,Ski,FLP
TT-2 (0856D)(2)(3)	0.0039	0.00130	*	*	Evaporation Pond
WW-2 (0868A)(2)	0.00060	0.000070	0.00070	8.0	FLP,NL,SC,SL,FLA,Ski
094 (0948C) Strip	0.00047	0.0004	0.000040	7.6-7.8	E,NL,Ski,FLP,T
094 (0948C) Sheet	0.0013	0.00091	0.00013	7.6-7.8	E,NL,FLP,T,Ski
097 (0760)(2)	0.00131	0.0017	*	*	Evaporation and Crystallization
Continuous-Acid Recovery					
T-2 (0792B)	0	0	0	-	

TABLE IX-2
JUSTIFICATION OF BPT EFFLUENT LIMITATIONS
SULFURIC ACID PICKLING SUBDIVISION
PAGE 2

FOOTNOTES

(1) Load permitted only for joint treatment with cold rolling wastewaters.
(2) Plants with scrubbers
(3) Plant uses evaporation pond with no discharge. Quality shown is feed to pond.
(4) Plant neutralizes rinses, settles out solids in a lagoon, and recycles all treated wastewaters.
(5) Plant neutralizes rinses and spent concentrates, and impounds the sludges, with no discharge.

* : Limitation not supported
Neg: Load less than 0.000010 lb/1000 lbs

C&TT CODES

A : Aeration
CRCC: Chemical reduction chromium conversion
E : Equalization
EB : Emulsion breaking
F : Filtration
FLA : Flocculation with alum

FLP: Flocculation with polymer
NL : Neutralization with lime
SC : Sedimentation via clarifier
SKi: Skimming
SL : Settling lagoon
T : Sedimentation via thickener

TABLE IX-3

JUSTIFICATION OF BPT EFFLUENT LIMITATIONS
HYDROCHLORIC ACID PICKLING SUBDIVISION

	Effluent Limitations (kg/kkg)				
	TSS	O&G(1)	Dissolved Iron	pH (Units)	C&TT
BPT Effluent Limitations (3/76)					
Batch and Continuous Neutralization					
with scrubbers	0.0584	0.0117	0.00117	6-9	
without scrubbers	0.0480	0.00960	0.000960	6-9	
Continuous Acid Regeneration					
with scrubbers	0.0938	0.0187	0.00187	6-9	
without scrubbers	0.0834	0.0166	0.00166	6-9	
Actual Effluent Loads					
Batch Neutralization					
U-2 (0480A)(4)	*	0.00194	0.00020	8.5	NL
V-2 (0936)(4)	0.136	0.009	*		NC
Continuous Neutralization					
Z-2 (0396D)(2)(4)	0.024	0.00069	0.000162	8.1-8.6	E,NL,VF,SC
AA-2 (0384A)(2)(3)	*	*	*	*	None
091 (0612)	0.0111	0.00076	0.00030	8.4	NL,FDS,VF,SC
093 (0396D)(2)(4)	0.0156	0.0088	0.00073	9.1	NL,VF,E,SC
100 (0384A)(2)	0.0021	0.000077	*	8.2	SC
Continuous Acid Regeneration					
X-2 (0060B)(2)	0.025	ND	*	*	AR
Y-2 (-)(2)	0.0026	0.0011	*	*	AR
95 (0584F)(2)	0.0048	0.00029	*	*	
99 (0528B)(2)	0.0128	0.0144	0.00024	7.0	AR,NL,SL

---

(1) Load permitted only for joint treatment with cold rolling wastes.
(2) Plants with scrubbers.
(3) Plants discharged to deep well. Later visit (see Plant 100) gives current data on present treatment system.
(4) Plant discharges to a POTW.

NA: Not applicable.
* : Limitation not supported.

C&TT CODE

AR : Acid regeneration
E : Equalization
FDS: Filtration-deep bed sand
NC : Neutralization with caustic
NL : Neutralization with lime
SC : Sedimentation via clarifier
SL : Sedimentation via lagoon
VF : Vacuum filtration

TABLE IX-4

JUSTIFICATION OF BPT EFFLUENT LIMITATIONS
COMBINATION ACID PICKLING SUBDIVISION

	Effluent Limitations (kg/kkg)						
	TSS	O&G(1)	Dissolved Iron	Chromium	Fluoride(2)	Nickel	C&TT
Proposed BPT Effluent Limitations							
Batch-Pipe & Tube	0.0730	0.0292	0.00292	0.00146	0.0438	0.000730	
Actual BPT Loads							
U (Unk)	0.0339	0.0028	0.000057	0.0001	0.0339	0.00005	NL,SL
123 (088A)	0.00646	ND	0.00128	ND	NR	0.000776	E,NL,FLP,CL
Proposed BPT Effluent Limitations							
Batch-Other	0.0209	0.00834	0.000834	0.000417	0.0125	0.000209	
Actual BPT Loads							
C (0424)	0.0118	0.00010	*	*	*	*	E,NL,PSP
Proposed BPT Effluent Limitations							
Continuous	0.104	0.0417	0.00417	0.00209	0.0626	0.00104	
Actual BPT Loads							
O (0176)	0.0824	0.00196	0.00785	*	*	*	E,NL,FLP,SC,T
121 (Unk)	0.0446	0.0247	0.00145	*	0.0544	*	E,SC,CR

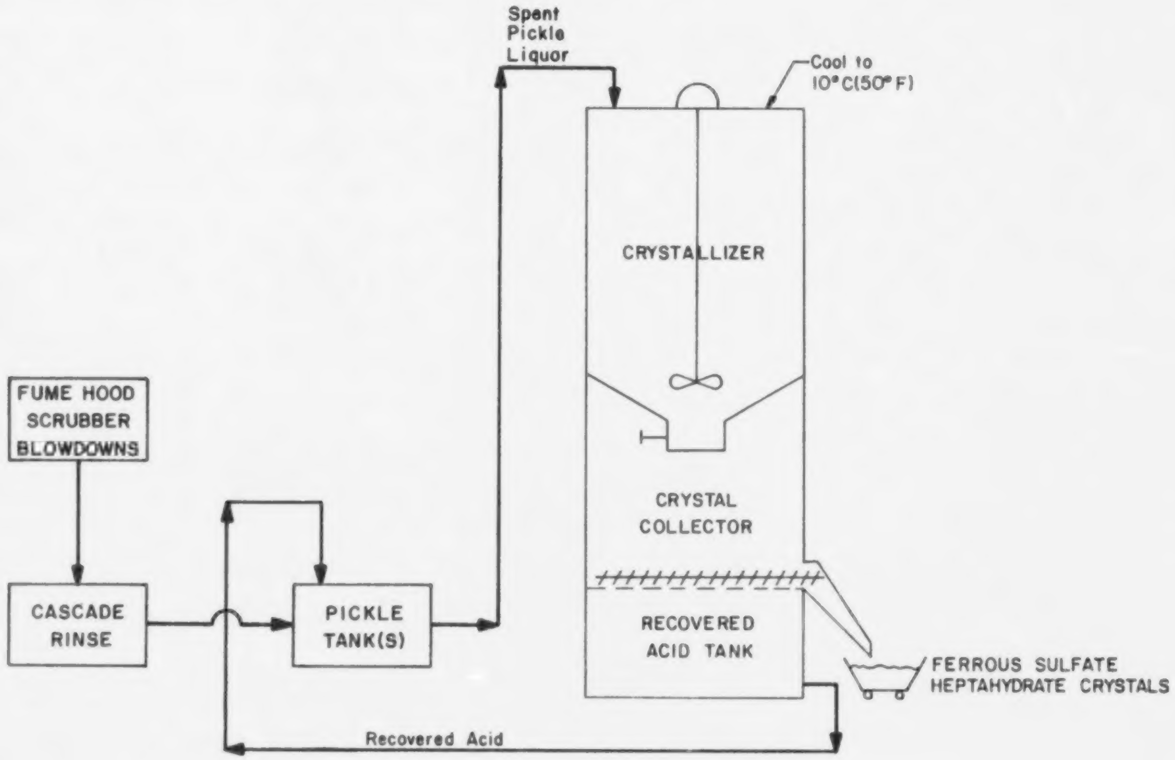
---

(1) Load permitted only when joint treatment with cold rolling wastewaters is practiced.
(2) Load permitted only when hydrofluoric acid is used.

* : Limitation not supported. Where inadequate treatment was demonstrated within the subcategory, limitations will be justified by transfer of technology.
NR: Not reported.
ND: Not detected.

C&TT CODE

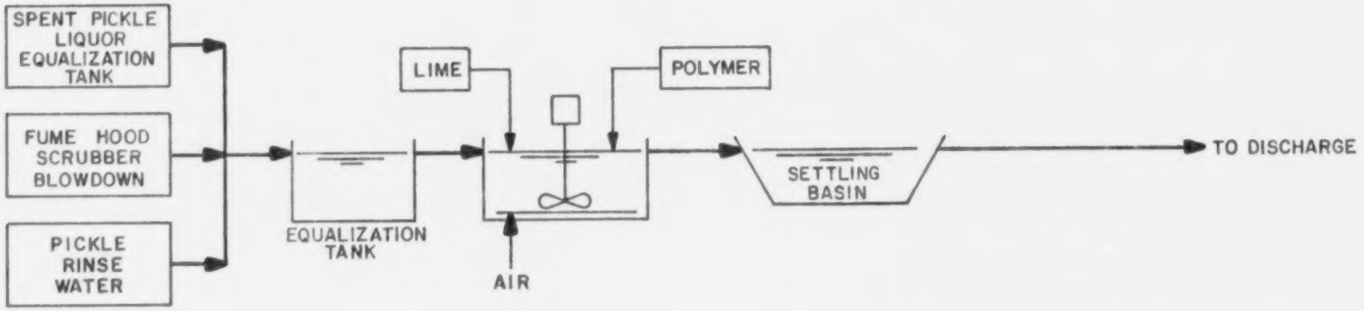
E : Equalization
CR : Chemical reduction
FLP: Flocculation with polymer
NL : Neutralization with lime
PSP: Primary scale pit
SC : Sedimentation via clarifier
T : Sedimentation via thickener



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING
CONTINUOUS & BATCH ACID RECOVERY
BPT MODEL

Dwn.6/12/80

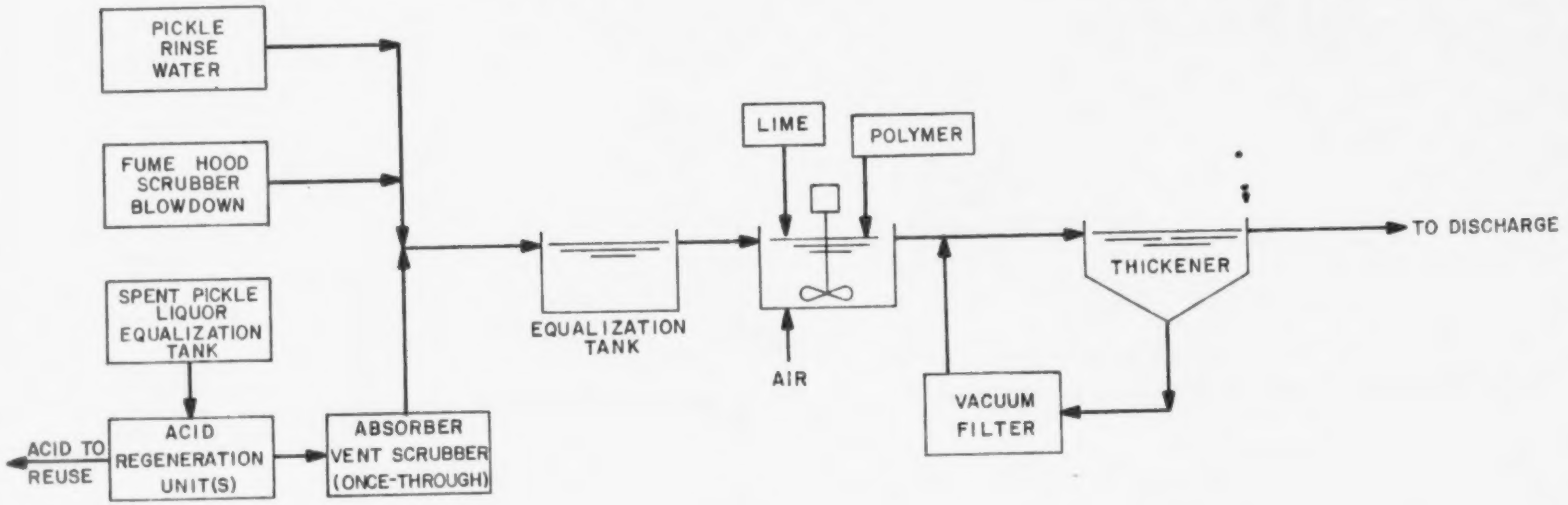
FIGURE IX-1



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BPT MODEL

Dwn.6/13/80

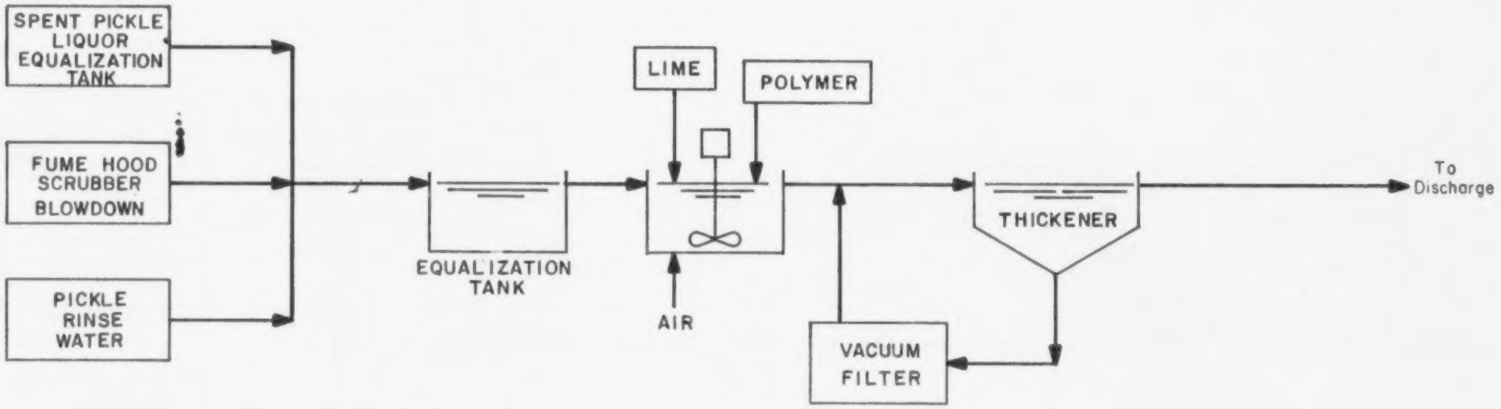
FIGURE IX-2


PICKLE RINSE WATER
FUME HOOD SCRUBBER BLOWDOWN
SPENT PICKLE LIQUOR EQUALIZATION TANK
ACID TO REUSE
ACID REGENERATION UNIT(S)
ABSORBER VENT SCRUBBER (ONCE-THROUGH)
EQUALIZATION TANK
LIME
POLYMER
AIR
VACUUM FILTER
THICKENER
TO DISCHARGE

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
CONTINUOUS ACID REGENERATION
BPT MODEL

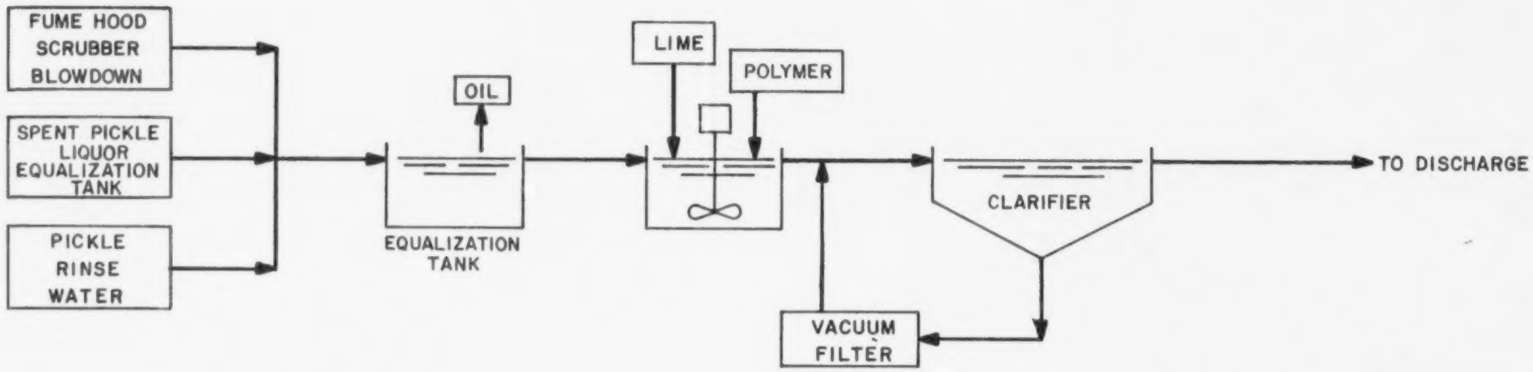
Dwn.6/17/80

FIGURE IX-3



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BPT MODEL
Dwn.6/16/80

FIGURE IX-4



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BPT MODEL

Dwn.6/18/80

FIGURE IX-5

ACID PICKLING SUBCATEGORY

SECTION X

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

Introduction

The Best Available Technology Economically Achievable (BAT) effluent limitations are to be attained by July 1, 1984. BAT is determined by reviewing subcategory practices and identifying the best economically achievable control and treatment technologies employed within the subcategory. In addition, where a technology is readily transferable from one subcategory or industry, such technology may be identified as BAT.

This section identifies the model BAT flow rates, three BAT alternative treatment systems, and the resulting effluent levels considered for the acid pickling subcategory. In addition, the rationale for the Agency's selection of the alternative treatment systems, applied and discharge flow rates, and effluent pollutant concentrations are presented. Finally, this section addresses the Agency's selection of a BAT model treatment system to serve as the basis for the proposed BAT limitations.

Identification of BAT

Based upon information contained in Sections III through VIII of this report, the Agency developed the following three alternative treatment systems (as add-ons to the BPT treatment system models) for the acid pickling subcategory. These three alternatives are applicable to all pickling operations except for those practicing sulfuric acid recovery. The acid recovery operations attain zero discharge at BPT. Therefore, no further treatment is necessary beyond BPT.

BAT Alternative No. 1

The first BAT alternative treatment system reduces the flow being discharged from the rinse operations through the application of a cascade or countercurrent rinse system. The fume scrubber blowdown may be eliminated by feeding it to the cascade rinse system. Zero discharge of fume scrubber wastewaters could also be achieved by 100% recycle. At the present time, plants in the sulfuric and hydrochloric acid subdivisions have demonstrated zero discharge of fume scrubber waters through blowdown to the cascade rinse system. Other plants have achieved zero discharge by using mist filters in lieu of wet scrubbers.

BAT Alternative No. 2

The second BAT alternative treatment system employs the same cascade rinse system presented in the description of Alternative No. 1. In addition, toxic metals removals are improved by the installation of a sulfide precipitation system followed by a filter. The filter removes suspended solids in the wastewater and the toxic metals entrained in the suspended solids.

BAT Alternative No. 3

The third BAT alternative treatment system also employs the cascade rinse system described in Alternative No. 1. In addition, this alternative achieves zero discharge of the entire wastewater flow. Evaporation, with the use of a multi-stage evaporator, a condenser, and a centrifuge to dewater the slurries generated, are included to achieve zero discharge. The distillate quality water, which is produced by this system, is recycled back to the acid pickling operation.

Figures X-1 through X-4 illustrate the BAT alternative treatment systems described previously for the acid pickling subcategory. The treatment technologies shown represent those technologies in use at one or more plants, or demonstrated in other wastewater treatment applications, and considered to be capable of attaining the respective BAT effluent levels.

Pollutants Limited at BAT

The BAT effluent limitations for each alternative treatment system are presented in Table X-16. The pollutants listed in this table represent a condensation of the list of selected pollutants presented in Section VI. The Agency selected pollutants for limitation based upon the following factors: treatability using the technologies presented in the alternative treatment systems, and the ability to serve as indicators of both the presence and the removal of other pollutants.

Analytical data indicate that chromium, lead, and zinc predominate in sulfuric and hydrochloric acid pickling wastewaters. Chromium, copper, and nickel are found at much higher levels and in much greater quantities than other toxic pollutants in combination acid pickling wastewaters. Based upon these observations, the Agency has selected chromium, lead, and zinc for sulfuric and hydrochloric operations and chromium, copper, and nickel for combination operations, as the toxic pollutants to be limited at BAT. Other toxic metals could be found in acid pickling wastewaters; however, control of the toxic metals listed in Table X- 16 will also result in comparable control of the other toxic metals. Toxic organics have also been found in acid pickling wastewaters at very low levels. However, the cascade rinse system, which is part of all three BAT alternative treatment systems, will provide significant reductions in toxic organic pollutant loads, as well as in toxic metal pollutant loads, by reducing the discharge volume.

In addition to the toxic metals listed above, fluoride is also limited at BAT in the combination acid subdivision. However, these limitations only apply when hydrofluoric acid is used in the pickling process.

Rationale for BAT

The following discussion presents the rationale for the selection of the BAT model treatment systems and for the determination of the flow rates and effluent concentrations of the critical pollutants.

Treatment Scheme

The cascade rinse system included in the first BAT alternative treatment system is commonly used by plants in the acid pickling subcategory. The 85% recycle rate used to develop BAT model flows has been demonstrated by two acid pickling plants. In addition, zero discharge from the fume scrubber recycle system has been demonstrated by plants in the sulfuric and hydrochloric acid pickling subdivisions. Zero discharge is being achieved by reuse of the fume scrubber blowdown in the rinsing operation, and by total recycle (100%) of the fume scrubber wastewater system.

The sulfide precipitation system incorporated in the second BAT alternative treatment system is not presently demonstrated in this subcategory. However, its effectiveness in removing toxic metals from wastewaters has been demonstrated in studies involving wastewaters from other metals manufacturing operations. Filtration, used to remove solids and metals precipitated with sulfide, has also been proven in other subcategories.

The evaporation technology included in the third BAT alternative treatment system is extremely costly and energy intensive in comparison to the other BAT alternative treatment systems.

BAT Flow Rates

The best applied flows were averaged for each acid pickling segment for the purposes of sizing and costing treatment systems and establishing effluent limitations. These averages of concentrate, rinse, fume scrubber, and absorber vent scrubber (if applicable) streams for the various acid pickling segments appear in Tables X-1 through X-14. The flow rates for this subcategory were developed as explained below.

Raw Wastewater Flow Values

The BAT raw flow rates were determined by summing the appropriate concentrate, rinse, fume scrubber, and absorber vent scrubber (if applicable) flows.

Bat Feed Flow Values

The BAT feed flow rates were determined by summing the appropriate concentrate, rinse, fume scrubber blowdown, and absorber vent scrubber (if applicable) flows. The best discharge fume scrubber values were averaged to determine fume scrubber blowdowns. All acid pickling segments, except for combination continuous, demonstrated 10 gal/ton of fume scrubber blowdown. Combination continuous operations demonstrated 50 gal/ton of fume scrubber blowdown.

BAT Model Flow Values

The model BAT flows were determined by summing the appropriate concentrate, cascade rinse blowdown, fume scrubber blowdown, and absorber vent scrubber blowdown (if applicable) flows. Data from two pickling operations (0584F and 0384A) demonstrate rinse flow reductions with cascade rinse systems in excess of 85%.

Based on these data, model BAT feed rinse flows were reduced by 85% at the BAT level. Several hydrochloric acid regeneration operations have demonstrated 80% recycle of absorber vent scrubber (AVS) streams. Based on these data, BAT feed AVS flows were reduced to 20% of the original value, at the BAT level. In addition, the fume scrubber flow was reduced to zero at BAT for sulfuric and hydrochloric operations. This reduction was based upon the sulfuric and hydrochloric operations which have demonstrated the ability to blow down any remaining fume scrubber flow to the cascade rinse system. This type of reduction has not been demonstrated at combination acid plants. The fume scrubber flow could also be reduced by 100% recycle of the fume scrubber wastewaters as reported for many plants.

Refer to Table X-15 for the development of model BAT flow rates.

Wastewater Quality

The average effluent concentrations incorporated in each BAT alternative treatment system follow (the maximum values are enclosed in parentheses):

Pollutant, mg/l	BAT-1	BAT-2	BAT-3
Fluoride[1]	15 (45)	15 (45)	-
Chromium[2]	0.10(0.30)	0.10(0.30)	-
Copper[3]	0.10(0.30)	0.10(0.30)	-
Lead[4]	0.10(0.30)	0.10(0.30)	-
Nickel[3]	0.20(0.45)	0.10(0.30)	-
Zinc[4]	0.10(0.30)	0.10(0.30)	-

[1] Fluoride is limited in the combination acid subdivision only when hydrofluoric acid is used.

[2] Chromium is limited in all three acid pickling subdivisions.

[3] Copper and nickel are limited in the combination acid pickling subdivision only.

[4] Lead and zinc are limited in the sulfuric acid and hydrochloric acid pickling subdivisions only.

Toxic Metal Pollutants

A. BAT Alternative No. 1

The cascade rinse system in this alternative achieves a substantial flow reduction which results in a comparable pollutant load reduction. The pollutant concentrations in the remaining flow are dependent upon the preceding treatment components. Thickeners, clarifiers, or settling basins with chemical addition are incorporated at the BPT level of treatment. Short-term data involving these treatment components, in pickling and other related subcategories, were reviewed to determine the toxic metal removal capabilities of these wastewater treatment components. Reference is made to Volume I, Appendix A, for the derivation of 30-day average and daily maximum performance standards for Alternative No. 1.

B. BAT Alternative No. 2

As noted previously in this section, BAT Alternative No. 2 incorporates a sulfide precipitation and filtration system in addition to the cascade rinse system in Alternative No. 1. As sulfide precipitation technology has not been demonstrated in this subcategory, the capabilities of this technology have been transferred from other metals manufacturing wastewater treatment applications. The toxic metals effluent levels which can be achieved with this treatment technology were developed on the basis of the data review presented in Volume I. The data indicate that average toxic metals effluent concentrations of 0.10 mg/l can be attained with this treatment technology.

C. BAT Alternative No. 3

The evaporation system incorporated in BAT Alternative No. 3 achieves zero discharge of process wastewater pollutants.

Effluent Limitations for Alternative Treatment Systems

The effluent limitations for the BAT alternative treatment systems were calculated by multiplying the model effluent flow incorporated in each alternative treatment system and the corresponding concentration of metals with appropriate conversion factors. Table X-16 presents the effluent limitations developed for each alternative treatment system in each segment of the subcategory.

Selection of a BAT Alternative

The Agency has selected BAT Alternative No. 1 as the model treatment system upon which the proposed BAT limitations are based. Cascade rinse systems are well demonstrated in the acid pickling subcategory, while sulfide precipitation and evaporation techniques are not. For this reason, the first alternative was selected as the BAT model treatment system. The proposed BAT effluent limitations are presented in Table X-16 under the Alternative No. 1 heading.

TABLE X-1

ANALYSIS OF FLOW DATA
SULFURIC ACID PICKLING-BATCH
APPLIED FLOW RATE (GPT)

Plant Code	Concentrates	Rinses	Basis
0088A-1	8.1	<1	DCP
0946A-3	5.4	3.5	DCP
0088D-1	14.2	4.7	DCP
0248A-2	8.1	6.0	DCP
0946A-1	10.4	6.4	DCP
0894	24.3	8.0	Sampled Data
0684D-2	8.9	8.3	DCP
0946A-2	18.8	8.6	DCP
0112-1	11.9	9.7	DCP
0248A-3	10.0	10.0	DCP
0048D-2	10.4	10.4	DCP
0684P-1	9.9	11.2	DCP
0048B	5.5	15	DCP
0684E-1	17.5	15.7	DCP
0312	17.6	16.9	Sampled Data
0060M	2.2	17.3	DCP
0684P-3	10.0	17.4	DCP
0590	Unk	18.0	Sampled Data
0048D-1	27.0	27.0	DCP
0048F	13	37	DCP
0684P-2	10.0	40.3	DCP
0684E-4	17.5	41	DCP
0916A-2	18.0	42	DCP
0088A-2	22.6	49.2	DCP
0684G-1	3.5	54.3	DCP
0856T	5.6	55.8	DCP
0048B	20.0	58.3	DCP
0856U	23.7	62	DCP
0584C	9.7	62.3	DCP
0240B	10.5	62.9	DCP
0684G-2	11.9	74.5	DCP
0884G	11.0	77.0	DCP
0684D-3	8.9	77.4	DCP
0248A-1	9.4	84.4	DCP
0240A	Unk	85.4	DCP
0476A	Unk	91	Sampled Data
0492A	3.5	91	Sampled Data
0256G	18.3	107	DCP
0088A-4	16.3	117	DCP
0612	14.6	122	Sampled Data

TABLE X-1
ANALYSIS OF FLOW DATA
SULFURIC ACID PICKLING-BATCH
APPLIED FLOW RATE (GPT)
PAGE TWO

Plant Code	Concentrates	Rinses	Basis
0088A-5	42.1	132	DCP
0856S	2.76	134	DCP
0240C	3.8	141	DCP
0856N-3	11.7	160	DCP
0684V	21.0	164	DCP
0916A-7	15.0	165	DCP
0384A-2	2.5	180	DCP
0460D	28.9	181	DCP
0856N-2	21.7	209	DCP
0684Q	24.6	215	DCP
0460G	22.7	224	DCP
0112-2	22.5	231	DCP
0460F	32.6	261	DCP
0088A-3	14.6	272	DCP
0460E	13.3	280	DCP
0728	7.8	288	DCP
0684E-3	17.5	297	DCP
0856F-3	7.7	346	DCP
0868A-1	5.0	349	DCP
0264	17.1	382	DCP
0864B-1	9.2	398	DCP
0884C	25.0	400	DCP
0460C	12.5	410	DCP
0856N-1	20	432	DCP
0264D	13.6	446	DCP
0860F	16.6	465	DCP
0856Q	15	480	DCP
0460H	27.7	535	DCP
0264C	11.8	589	DCP
0548B	27.0	649	DCP
0856P-2	13.5	696	DCP
0068	70 **	769	DCP
0684E-2	17.5	820	DCP
0460A-1	25.8	824	DCP
0548-1	8.9	853	DCP
0860G	22.4	862	DCP
0640-1	27.6	898	DCP
0684H-1	25.3	913	DCP
0256F	4	960	DCP
0548-3	9.0	960	DCP
0548-2	9.0	961	DCP

TABLE X-1
ANALYSIS OF FLOW DATA
SULFURIC ACID PICKLING-BATCH
APPLIED FLOW RATE (GPT)
PAGE THREE

Plant Code	Concentrates	Rinses	Basis
0548-4	9.1	965	DCP
0460A-3	27.0	973	DCP
0920D	33.7	1079	DCP
0948B	Unk	1081	DCP
0856F-2	4.1	1126	DCP
0884D	16.7	1200	DCP
0384A-1	14.3	1379	DCP
0088D-2	Unk	2775**	DCP
0948A	48.9**	3810**	DCP
0460A-2	47.8**	4174**	DCP
0640-2	7.6	8291**	DCP
0060C	8	Unk	DCP
0112A-2	4.5	Unk	DCP
0112C-1	22.1	Unk	DCP
0112C-2	8.9	Unk	DCP
0112C-3	9.9	Unk	DCP
0112F-1	5.1	Unk	DCP
0112F-2	3.8	Unk	DCP
0112I-1	10.5	Unk	DCP
0112I-2	20.5	Unk	DCP
0112I-3	14.8	Unk	DCP
0112I-4	25.9	Unk	DCP
0112I-5	33.7	Unk	DCP
0112I-6	110 **	Unk	DCP
0112I-7	22.3	Unk	DCP
0432A-2	26	Unk	DCP
0432A-3	25.1	Unk	DCP
0432A-4	19.2	Unk	DCP
0856R	8.5	Unk	DCP

Unk: Unknown
- : Not present
** : Not used in "Average of the Best" Calculation

APPLIED FLOW RATE AVERAGES

Concentrates

Average of all sources	17.4 GPT
"Average of the best"	15.6 GPT

Rinses

Average of all sources	537 GPT
"Average of the best"	327 GPT

Note: The above averages include confidential data

TABLE X-2

ANALYSIS OF FLOW DATA
SULFURIC ACID PICKLING-BATCH

Plant Code	Applied Flow Rate (GPT) Scrubbers	Discharge Flow Rate (GPT) Scrubbers	Basis
0460H	306	0	DCP
0856N-3	534	133**	DCP
0548-2	846	0	DCP
0856N-1	960	240**	DCP
0240C	1000	41	DCP
0384A-2	1200	156**	DCP
0856F-3	2677**	185**	DCP
0856F-2	7518**	162**	DCP

** = Not used in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Scrubbers

Average of all sources	1684 GPT
"Average of the best"	708 GPT

DISCHARGE FLOW RATE AVERAGES (Of those plants practicing flow reduction)

Scrubbers

Average of all sources	102 GPT
"Average of the best"	10.3 GPT

Note: The above averages include confidential data.

TABLE X-3

ANALYSIS OF FLOW DATA
SULFURIC ACID PICKLING-CONTINUOUS

Plant Code	Applied Flow Rate (GPT) Concentrates	Rinses	Basis
0856P	27.5	1.95	DCP
0760	7.2	11.1	Sampled Data
0112A-6	29.2	11.5	DCP
0528A-2	14.7	19.6	DCP
0256C-1	11.0	29.4	DCP
0256C-2	11.0	29.4	DCP
0856F	18.0	54	DCP
0112A-12	34.7	80	DCP
0112A-13	34.7	80	DCP
0112A-10	34.7	86	DCP
0868A-3	36.8	96	DCP
0432A-1	14.4	115	DCP
0122A-7	8.4	127	DCP
0792C	39.0	127	DCP
0856D-3	13.0	129	DCP
0868A-4	45.6	133	DCP
0112A-4	14.4	136	DCP
0112A-5	18	143	DCP
0856D-2	11.5	143	DCP
0112A-3	17	149	DCP
0948C-4	11.3	161	DCP
0868A-2	40.5	162	DCP
0112A-11	11.7	170	DCP
0864B-2	24.8	170	DCP
0864B-4	27.7	190	DCP
0256A	9.7	209	DCP
0856D-4	10.2	225	DCP
0864B-3	37.4	257	DCP
0684C	21.3	284	DCP
0584E	15.8	300	DCP
0948C-1	21.4	303	Sampled Data
0856D-1	15.9	310	DCP
0396E-1	Unk	328	DCP
0112A-8	27.9	338	DCP
0868A-5	23.9	345	DCP
0948C-2	21.4	422	Sampled Data
0112A-9	30.9	423	DCP
0256B	15	425	DCP
0432B	17	427	DCP
0856U-2	12.7	467	DCP

TABLE X-3
ANALYSIS OF FLOW DATA
SULFURIC ACID PICKLING-CONTINUOUS
PAGE TWO

Plant Code	Applied Flow Rate (GPT) Concentrates	Applied Flow Rate (GPT) Rinses	Basis
0432M	7.8	469	DCP
0948C-3	13.6	532	DCP
0020B	6.4	539	DCP
0856E	21.4	758**	DCP
0176	Unk	847**	DCP
0580C	10.4	1184**	DCP
0432L	3.3	1200**	DCP
0580-2	31.3	1800**	DCP
0580-1	16.7	4000**	DCP
0384A-3	51.4**	4141**	DCP
0580-3	20.0	10,000**	DCP
0060D-2	5.0	Unk	DCP
0112D	Unk	Unk	DCP
0528A-1	Unk	Unk	DCP

**: Not used in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Concentrates	
Average of all sources	20.5 GPT
"Average of best"	19.9 GPT

Rinses	
Average of all sources	649 GPT
"Average of best"	213 GPT

TABLE X-4

ANALYSIS OF FLOW DATA
SULFURIC ACID PICKLING-CONTINUOUS

Plant Code	Applied Flow Rate(GPT) Scrubbers	Discharge Flow Rate(GPT) Scrubbers	Basis
0112A-11	16.7	16.7	DCP
0856D-4	20.5	20.5	DCP
0112A-4	23	23	DCP
0856D-1	44	44	DCP
0528A-2	55.9	55.9	DCP
0856F	62	11.3**	DCP
0020B	90	90	DCP
0856D-3	97	97	DCP
0256A	104	104	DCP
856D-2	143	143	DCP
0856P	232	232	DCP
0432M	234	234	DCP
0792C	237	0	DCP
0856E	253	253	DCP
0684C	284	284	DCP
0256B	425**	425	DCP
0868A-3	448**	0	DCP
0868A-4	597**	0	DCP
0176	750**	750	DCP
0868A-2	908**	0	DCP
0060D-2	Unk	Unk	DCP
0112A-3	Unk	Unk	DCP
0112A-5	Unk	Unk	DCP
0112A-6	Unk	Unk	DCP
0112A-7	Unk	Unk	DCP
0112A-8	Unk	Unk	DCP
0112A-9	Unk	Unk	DCP
0112D	Unk	Unk	DCP
0432B	Unk	Unk	DCP
0528A-1	Unk	Unk	DCP
0584E	Unk	Unk	DCP
0868A-5	Unk	Unk	DCP

Unk: Unknown
**: Not used in "Average of best" calculation

APPLIED FLOW RATE AVERAGE

Scrubbers

Average of all sources	251 GPT
"Average of best"	126 GPT

DISCHARGE FLOW RATE AVERAGE (all plants practicing flow reduction)

Scrubbers

Average of all sources	2.3 GPT
"Average of best"	0 GPT

TABLE X-5

ANALYSIS OF FLOW DATA
HYDROCHLORIC ACID PICKLING-BATCH

Plant Code	Applied Flow Rate (GPT) Concentrates	Rinses	Basis
0480A	6.5	92.9	Sampled data
0936	3.9	167	Sampled data
0384A-6	4.4	469	DCP
0864B	6.6	1319	DCP
0176	Unk	1811**	DCP
0580A-3	38.0**	1950**	DCP
0060L	4.0	13,400**	DCP

Unk: Unknown
**: Not used in "Average of best" calculation

APPLIED FLOW RATE AVERAGES

Concentrates

Average of all sources	11.6 GPT
"Average of best"	7.2 GPT

Rinses

Average of all sources	2481 GPT
"Average of best"	538 GPT

TABLE X-6

ANALYSIS OF FLOW DATA
HYDROCHLORIC ACID PICKLING-BATCH

Plant Code	Applied Flow Rate (GPT) Scrubbers	Discharge Flow Rate (GPT) Scrubbers	Basis
0864B	132	0	DCP
0384A-6	169	169	DCP

Unk: Unknown
-: Not present
**: Not used in "Average of best" calculation

APPLIED FLOW RATE AVERAGES

Scrubbers

Average of all sources	399 GPT
"Average of best"	150 GPT

DISCHARGE FLOW RATE AVERAGES (of those plants practicing flow reduction)

Scrubbers

Average of all sources 0 GPT

Note: The above averages inlcude confidential data.

TABLE X-7

ANALYSIS OF FLOW DATA
HYDROCHLORIC ACID PICKLING-CONTINUOUS

Plant Code	Applied Flow Rate (GPT) Concentrates	Rinses	Basis
0612-5	<1	0	DCP
0384-4	7.2	7.7	DCP
0856F	9.6	60	DCP
0948A-1	3.7	61	DCP
0948A-2	4.4	71	DCP
0724A-4	7.3	84	DCP
Y-2	Unk	87.3	Sampled Data
0684B-2	12.3	102	DCP
0684B-1	8.7	109	DCP
0724A-3	Unk	137	DCP
0584A-3	4.1	191	DCP
0528B	81.7**	216	Sampled Data
0584A-1	4.6	217	DCP
0584A-2	4.8	224	DCP
0584C	4.7	225	DCP
0920G	7.0	225	DCP
W-2	11.9	228	Sampled Data
0396D	203**	234	Sampled Data
0432C-2	15.3	239	DCP
0580-4	1.5	240	DCP
0580B-2	1.5	240	DCP
0580D-3	1.5	240	DCP
0580E-2	1.5	240	DCP
0580F-2	1.5	240	DCP
0584A-4	5.2	243	DCP
0920C	7.4	258	DCP
0920A-1	18.7	270	DCP
0060-2	13.7	274	DCP
0580-3	3.0	288	DCP
0580B-1	3.0	288	DCP
0580D-2	3.0	288	DCP
0920A-2	19.3	290	DCP
0060-1	14.8	295	DCP
0868A	25.4	299	DCP
0684F-2	8.2	305	DCP
0612	18.1	328	Sampled Data
0864B-4	8.8	330	DCP
0580-2	1.8	360	DCP
0580-6	3.8	360	DCP
0580B-3	1.8	360	DCP
0580D-1	1.8	360	DCP

TABLE X-7
ANALYSIS OF FLOW DATA
HYDROCHLORIC ACID PICKLING-CONTINUOUS
PAGE TWO

Plant Code	Applied Flow Rate (GPT)		Basis
	Concentrates	Rinses	
0580E-1	1.8	360	DCP
0580F-1	1.8	360	DCP
0068-2	8.0	367	DCP
0384-2	8.3	372	DCP
0864B-3	12.0	400	DCP
0384-3	7.7	450	DCP
0864B-1	2.5	487	DCP
0684F-1	7.3	500	DCP
0684F-3	8.1	503	DCP
0856S-1	0.8	589	DCP
0432D	8.5	596	DCP
0384-1	13.6	763	DCP
0864B-2	5.3	766	DCP
0020C	35	958	DCP
0580C-3	4.4	1152**	DCP
0724A-2	Unk	1200**	DCP
0856S-2	2.4	1309**	DCP
0580-5	33.3	1333**	DCP
0580-1	10.0	1440**	DCP
0580C-1	17.5	1440**	DCP
0068-1	13.2	2087**	DCP
0860F-1	7.0	3130**	DCP
0724A-1	Unk	4160**	DCP
0860F-2	12.8	5760**	DCP
0860F-3	12.8	5760**	DCP
0580C-2	13.0	6034**	DCP
0580A-1	5.9	6240**	DCP
0580A-2	117.5**	9333**	DCP
0856P	5.9	15,540**	DCP
0112B-1	Unk	Unk	DCP
0112B-2	Unk	Unk	DCP
0112B-3	Unk	Unk	DCP
0112D-1	Unk	Unk	DCP
0112D-2	Unk	Unk	DCP
0112H	20.9	Unk	DCP
0320-1	6.6	Unk	DCP
0320-2	5.1	Unk	DCP
0320-3	6.5	Unk	DCP
0320-4	6.1	Unk	DCP
0448A-1	9.8	Unk	DCP
0448A-2	7.0	Unk	DCP

TABLE X-7
ANALYSIS OF FLOW DATA
HYDROCHLORIC ACID PICKLING-CONTINUOUS
PAGE THREE

Unk: Unknown
**: Data not included in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Concentrates	
Average of all sources	14.0 GPT
"Average of best"	8.4 GPT
Rinses	
Average of all sources	1150 GPT
"Average of best"	295 GPT

Note: The above averages include confidential dta.

TABLE X-8

ANALYSIS OF FLOW DATA
HYDROCHLORIC ACID PICKLING-CONTINUOUS

Plant Code	Applied Flow Rate (GPT) Scrubbers	Discharge Flow Rate (GPT) Scrubbers	Basis
0020C	7.4	7.4	DCP
0384-4	7.7	7.7	DCP
0920A-1	16	16	DCP
0724A-4	17	17	DCP
0864B-4	18	0	DCP
0920A-2	18	18	DCP
0920C	24	24	DCP
0864B-3	25	0	DCP
0112D-2	45	Unk	DCP
0868A	45	0	DCP
0432C-2	47.8	47.8	DCP
0432C-1	49.2	49.2	DCP
0112D-1	58	Unk	DCP
0856F	66	12	DCP
0580-2	72	72	DCP
0432D	78.3	78.3	DCP
0528B	78.7	6.1	Sampled Data
0060-2	80.4	12.0	DCP
0724A-2	86	86	DCP
0060-1	86.8	12.9	DCP
0724A-3	88	78**	DCP
0684F-2	93	12	DCP
0684B-2	102	0	DCP
0112B-2	111	Unk	DCP
0580B-3	120	120	DCP
0580D-1	120	120	DCP
0580F-1	120	120	DCP
0584A-3	127	127	DCP
0584C	141	0.8	DCP
0580D-3	144	0	DCP
0580F-2	144	0	DCP
0320-4	144	144	DCP
0584A-1	145	145	DCP
0584A-2	149	149	DCP
0584A-4	162	162	DCP
0684F-1	166	21	DCP
0112B-3	183	Unk	DCP
0112B-1	202	Unk	DCP
0320-3	210	210	DCP
0320-1	214	214	DCP

TABLE X-8
ANALYSIS OF FLOW DATA
HYDROCHLORIC ACID PICKLING-CONTINUOUS
PAGE TWO

Plant Code	Applied Flow Rate (GPT) Scrubbers	Discharge Flow Rate (GPT) Scrubbers	Basis
0684B-1	217	217	DCP
0684F-3	251	251	DCP
0320-2	277	277	DCP
0580D-2	288	288	DCP
0580-3	288	288	DCP
0580B-1	288	288	DCP
0384-2	298	298	DCP
0724A-1	300	240**	DCP
0112H	358	Unk	DCP
0580-6	360	360	DCP
0948A-1	454	10	DCP
0384-3	463	463	DCP
0948A-2	536	12	DCP
0384-1	611	611	DCP
0060D	696	696	DCP
0856F	15,125**	0	DCP
0396D	Unk	31.1	Sampled Data
0448A-1	Unk	Unk	DCP
0448A-2	Unk	Unk	DCP
W-2	Unk	45.5	Sampled Data
Y-2	Unk	39.7	Sampled Data

**: Data not included in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Scrubbers
Average of all data 430 GPT
"Average of the best" 176 GPT

DISCHARGE FLOW RATE AVERAGES (includes only those plants which recycle)

Scrubbers
Average of all data 29.0 GPT
"Average of the best" 6.2 GPT

Note: The above averages include confidential data.

TABLE X-9

ANALYSIS OF FLOW DATA
COMBINATION ACID PICKLING-BATCH

	Applied Flow Rate (GPT)		
Plant Code	Concentrates	Rinses	Basis
0884F	<1	<1	DCP
0684P-1	12.0	38	DCP
0424-1	10.8	93	DCP
0060N	46.9	109	DCP
0684P-2	14.0	133.6	DCP
0684P-3	14.0	135.5	DCP
0580G	1.3	143	DCP
0068	27.6	162	DCP
0776F	1.2	169	DCP
0440A-1	6.9	178	DCP
0088A	4.1	310	Sampled Data
0256N-2	11	320	DCP
0284A	3.0	325	DCP
0856H	13.4	338	DCP
0776J	11.6	360	DCP
0440A-2	11	384	DCP
0796A	12.0	386	DCP
0684V	5.8	409	DCP
0424-2	45.7	463	DCP
0060I	Unk	611	DCP
0176-1	Unk	633	DCP
0580	1.0	640	DCP
0884E	6.3	650	Sampled Data
0748	Unk	677	Sampled Data
0176-7	Unk	711	DCP
0496	9.0	736	DCP
0088-1	6.6	791	DCP
0088-2	6.6	791	DCP
0176-6	Unk	805	DCP
0856E	12.3	922	DCP
0476A	31	932	DCP
0256F	9.5	960	DCP
0248C-1	2.4	1015	DCP
0176-2	Unk	1043	DCP
0776G	18.7	1050	DCP
0088D	Unk	1176	Sampled Data
0176C	41.3	1617**	DCP
0020B-3	52.1	2182**	DCP
0248C-3	2.7	2310**	DCP
0792A	4.0	2667**	DCP
0548A	0.6	2743**	DCP

TABLE X-9
ANALYSIS OF FLOW DATA
COMBINATION ACID PICKLING-BATCH
PAGE TWO

Plant Code	Applied Flow Rate (GPT) Concentrates	Applied Flow Rate (GPT) Rinses	Basis
0176D	35	3200**	DCP
0776H	42.7	3303**	DCP
0548B	16.1	3871**	DCP
0248C-2	20.8	8889**	DCP
0060P	8.2	Unk	DCP
0112A-1	3.9	Unk	DCP
0112C	16.3	Unk	DCP
0112H	6.5	Unk	DCP

Unk: Unknown
-: Not Present
**: Not used in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Concentrates

Average of all sources	14.1 GPT
"Average of best"	14.1 GPT

Rinses

Average of all sources	1169 GPT
"Average of best"	517 GPT

Note: The above averages include confidential data.

TABLE X-10

ANALYSIS OF FLOW DATA
COMBINATION ACID PICKLING-BATCH

Plant Code	Applied Flow Rate (GPT) Scrubbers	Discharge Flow Rate (GPT) Scrubbers	Basis
0856H	39.4	39.4	DCP
0284A	163	163	DCP
0432E	864	864	DCP
0176D	960	960	DCP
0176-2	2087	417**	DCP
0884E	2700	6.3	Sampled Data
0176-1	3550**	330**	DCP
0176-7	5689**	284**	DCP
0176-6	6443**	242**	DCP
0256F	7200**	0	DCP

- = Not present
** = Not used in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Scrubbers

Average of all sources	3344 GPT
"Average of the best"	1136 GPT

DISCHARGE FLOW RATE AVERAGES (Of those plants practicing flow reduction)

Scrubbers

Average of all sources	160 GPT
"Average of the best"	2.0 GPT

Note: The above averages include confidential data.

TABLE X-11

ANALYSIS OF FLOW DATA
COMBINATION ACID PICKLING-CONTINUOUS

Plant Code	Applied Flow Rate (GPT) Concentrates	Applied Flow Rate (GPT) Rinses	Basis
0948F	Unk	176	DCP
0284A-3	1.9	313	DCP
0284A-2	1.7	358	DCP
0432K-1	1.6	457	DCP
0176-3	Unk	558	DCP
0020L-2	7.2	1011	DCP
0020B-2	24.7	1029	DCP
0256O-3	7.5	1064	DCP
0020L-1	7.8	1087	DCP
0684D-7	11.2	1255	DCP
0020B-1	15.5	1333	DCP
0684D-14	12.8	1383	DCP
0684D-6	16.8	1387	DCP
0060E-1	8.2	1690	DCP
0684D-12	18.8	1714	DCP
0724A-1	Unk	1846	DCP
0684D-2	Unk	1867	DCP
0176-5	Unk	2000	DCP
0684D-3	23.4	2044	DCP
0648	15	2097	DCP
0684D-5	24.9	2100	DCP
0176-4	Unk	2182	DCP
0684D-11	22.4	2222	DCP
0248B-9	8.1	2237	DCP
0020C-6	Unk	2271	DCP
0684D-1	22.2	2291	DCP
0684D-10	7.6	2713	DCP
0248B-1	13.4	2721	DCP
0900	Unk	2754	Sampled Data
0020C-8	Unk	2900	DCP
0248B-5	10.6	2923	DCP
0684D-9	25.7	3120	DCP
0248B-3	13.9	3162	DCP
0248B-10	11.7	3230	DCP
0020C-1	Unk	4127**	DCP
0684D-4	Unk	4246**	DCP
0248B-4	13.4	4255**	DCP
0684D-8	18.4	4457**	DCP
0248B-6	21.1	4688**	DCP
0724A-2	Unk	4966**	DCP
0020C-5	Unk	5509**	DCP

TABLE X-11
ANALYSIS OF FLOW DATA
COMBINATION ACID PICKLING-CONTINUOUS
PAGE TWO

Plant Code	Applied Flow Rate (GPT)		Basis
	Concentrates	Rinses	
0432L	18	5571**	DCP
02560-1	11.5	5729**	DCP
02560-4	17.0	6051**	DCP
0020C-2	Unk	6288**	DCP
0020C-3	Unk	6288**	DCP
02560-2	15.3	6588**	DCP
0248B-8	13.1	7317**	DCP
0248B-2	40.2	7668**	DCP
0112G-2	6.0	7706**	DCP
0248B-7	16.5	9195**	DCP
0020C-4	Unk	9388**	DCP
0860F	Unk	22,400**	DCP
0060	23.4	Unk	DCP
0060D-1	Unk	Unk	DCP
0060D-2	Unk	Unk	DCP
0060D-3	Unk	Unk	DCP
0060D-4	Unk	Unk	DCP
0060D-5	Unk	Unk	DCP
0060D-6	Unk	Unk	DCP
0060E-2	2.5	Unk	DCP
0112A-2	18.8	Unk	DCP
0112C-3	6.0	Unk	DCP
0112C-4	6.0	Unk	DCP
0432K-2	Unk	Unk	DCP
0432K-3	Unk	Unk	DCP
0432K-4	Unk	Unk	DCP

Unk: Unknown
**: Not used in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Concentrates

Average of all sources	14.2 GPT
"Average of best"	14.2 GPT

Rinses

Average of all sources	3677 GPT
"Average of best"	1809 GPT

TABLE X-12

ANALYSIS OF FLOW DATA
COMBINATION ACID PICKLING-CONTINUOUS

Plant Code	Applied Flow Rate (GPT) Scrubbers	Discharge Flow Rate (GPT) Scrubbers	Basis
0020C-1	20.8	20.8	DCP
0060D-5	50.4	Unk	DCP
0432K-3	63	63	DCP
0284A-2	89	89	DCP
0432K-2	94	94	DCP
0060D-3	100	Unk	DCP
0020C-6	102	102	DCP
0284A-3	104	104	DCP
0432K-4	115	115	DCP
0020B-1	102	102	DCP
0020L-2	253	253	DCP
0256O-3	268	0	DCP
0020L-1	272	272	DCP
0248B-9	309	40	DCP
0020C-5	329	329	DCP
0724A-2	331	331	DCP
0020B-2	343	343	DCP
0248B-1	376	49	DCP
0648	400	0	DCP
0248B-5	403	53	DCP
0248B-10	446	58	DCP
0060D-6	511	Unk	DCP
0020C-4	561	561	DCP
0256O-1	697	0	DCP
0248B-3	703	95	DCP
0112A-2	750	750	DCP
0248B-4	766	0	DCP
0060E-1	777	777	DCP
0948F	882	0	DCP
0256O-2	941	0	DCP
0020C-8	1096	1096	DCP
0060D-2	1200	4.8	DCP
0176-4	1273	364**	DCP
0020C-2	1380	1380	DCP
0020C-3	1380	1380	DCP
0060E-2	1381	1381	DCP
0256O-4	1532	0	DCP
0060D-1	1579	63	DCP
0248B-2	1702	230**	DCP
0248B-6	2344	188**	DCP
0176-3	3189	80	DCP
0176-5	7000**	400**	DCP

TABLE X-12
ANALYSIS OF FLOW DATA
COMBINATION ACID PICKLING-CONTINUOUS
PAGE TWO

Plant Code	Applied Flow Rate (GPT) Scrubbers	Discharge Flow Rate (GPT) Scrubbers	Basis
0860F	11,520**	640**	DCP
0060	Unk	Unk	DCP
0060D-4	Unk	Unk	DCP
0724A-1	Unk	Unk	DCP

**: Not used in "Average of the best" calculation

APPLIED FLOW RATE AVERAGES

Concentrates

Average of all sources	1113 GPT
"Average of best"	716 GPT

DISCHARGE FLOW RATE AVERAGES (All plants practicing flow reduction)

Scrubbers

Average of all sources	115 GPT
"Average of best"	47.8 GPT

TABLE X-13

RAW WASTE LEVEL FLOW JUSTIFICATION ACID PICKLING

Subdivision	Actual Applied Flow Rate (GPT)			Listed Values (GPT)		
	Concentrates	Rinses	Scrubbers	Concentrates	Rinses	Scrubbers
Sulfuric Acid -Batch	15.6	327	708	20	330	710
Sulfuric Acid -Continuous	19.9	213	126	20	200	130
Hydrochloric Acid -Batch	7.2	538	150	10	540	150
Hydrochloric Acid -Continuous	8.4	295	176	10	300	180
Combination Acid -Batch	14.1	517	1136	15	520	1140
Combination Acid -Continuous	14.2	1809	716	15	1800	720

TABLE X-14

ANALYSIS OF FLOW DATA
ABSORBER VENT SCRUBBER

Plant Code	Flow Rate (GPT) Scrubber	Basis
0584F	69	Sampled Data
W-2	98.6	Sampled Data
0528B	176	Sampled Data
0684F	376**	DCP
Y-2	624**	Sampled Data

**: Not used in "Average of the best" calculations.

SCRUBBER FLOW RATE AVERAGES

Average of all sources	269 GPT
"Average of the best"	115 GPT

TABLE X-15

DEVELOPMENT OF BAT FLOW RATES

Process	Treatment Level	Flow (GPT)				Total
		Conc.	Rinse	FHS	AVS	
Sulfuric Acid						
1. Batch Neutralization	Raw	20	330	710		1060
	BAT Feed	20	330	10		360
	BAT	20	50	0		70
2. Batch Acid Recovery	Raw	20	330	710		1060
	BAT Feed	-	-	-		0
	BAT	-	-	-		0
3. Continuous Neutralization	Raw	20	220	130		370
	BAT Feed	20	220	10		250
	BAT	20	35	0		55
4. Continuous Acid Recovery	Raw	20	220	130		370
	BAT Feed	-	-	-		0
	BAT	-	-	-		0
Hydrochloric Acid						
1. Batch Neutralization	Raw	10	540	150		700
	BAT Feed	10	540	10		560
	BAT	10	80	0		90
2. Continuous Neutralization	Raw	10	300	180		490
	BAT Feed	10	300	10		320
	BAT	10	45	0		55
3. Continuous Acid Regeneration	RAW	10	300	180	120	610
	BAT Feed	0	300	10	120	430
	BAT	0	45	0	25	70
Combination Acid						
1. Batch	Raw	15	520	1140		1675
	BAT Feed	15	520	10		545
	BAT	15	80	10		105
2. Continuous	Raw	15	1800	720		2535
	BAT Feed	15	1800	50		1865
	BAT	15	270	50		335

Conc: Concentrate
FHS: Fume Hood Scrubber
AVS: Absorber Vent Scrubber

TABLE X-16

BAT EFFLUENT LIMITATIONS
ACID PICKLING SUBCATEGORY

Subdivision	Process	BAT Alternative	Discharge Flow (GPT)	Pollutants	Concentration Basis (mg/l)		Effluent Limitations (lbs/1000 lbs)	
					AVE.	MAX.	AVE	MAX
Sulfuric	1 Batch - Neutralization	1*	70					
				Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
		2	70					
				Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
		3	0					
				Chromium	-	-	-	-
				Lead	-	-	-	
				Zinc	-	-	-	-
	2. Batch Acid Recovery	BPT	0	-	-	-	-	-
	3. Continuous - Neutralization	1*	55					
				Chromium	0.10	0.30	0.0000230	0.0000690
				Lead	0.10	0.30	0.0000230	0.0000690
				Zinc	0.10	0.30	0.0000230	0.0000690
		2	55					
				Chromium	0.10	0.30	0.0000230	0.0000690
				Lead	0.10	0.30	0.0000230	0.0000690
				Zinc	0.10	0.30	0.0000230	0.0000690
		3	0					
				Chromium	-	-	-	-
				Lead	-	-	-	-
				Zinc	-	-	-	-
	4. Continuous Acid Recovery	BPT	0	-	-	-	-	-

TABLE X-16
BAT EFFLUENT LIMITATIONS
ACID PICKLING SUBCATEGORY
PAGE 2

Subdivision	Process	BAT Alternative	Discharge Flow (GPT)	Pollutants	Concentration Basis (mg/l)		Effluent Limitations (lbs/1000 lbs)	
					AVE.	MAX.	AVE	MAX
Hydrochloric	1. Batch Neutralization	1*	90	Chromium	0.10	0.30	0.0000375	0.000113
				Lead	0.10	0.30	0.0000375	0.000113
				Zinc	0.10	0.30	0.0000375	0.000113
		2	90	Chromium	0.10	0.30	0.0000375	0.000113
				Lead	0.10	0.30	0.0000375	0.000113
				Zinc	0.10	0.30	0.0000375	0.000113
		3	0	Chromium	-	-	-	-
				Lead	-	-	-	-
				Zinc	-	-	-	-
	2. Continuous Neutralization	1*	55	Chromium	0.10	0.30	0.0000229	0.0000688
				Lead	0.10	0.30	0.0000229	0.0000688
				Zinc	0.10	0.30	0.0000229	0.0000688
		2	55	Chromium	0.10	0.30	0.0000229	0.0000688
				Lead	0.10	0.30	0.0000229	0.0000688
				Zinc	0.10	0.30	0.0000229	0.0000688
		3	0	Chromium	-	-	-	-
				Lead	-	-	-	
				Zinc	-	-	-	-
	3. Continuous Regeneration	1*	70	Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
		2	70	Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
		3	0	Chromium	-	-	-	-
				Lead	-	-	-	
				Zinc	-	-	-	-

TABLE X-16
BAT EFFLUENT LIMITATIONS
ACID PICKLING SUBCATEGORY
PAGE 3

Subdivision	Process	BAT Alternative	Discharge Flow (GPT)	Pollutants	Concentration Basis (mg/l)		Effluent Limitations (lbs/1000 lbs)	
					AVE.	MAX.	AVE	MAX
Combination	1. Batch	1*	105					
				Fluoride	15	45	0.00657	0.0197
				Chromium	0.10	0.30	0.0000438	0.000131
				Copper	0.10	0.30	0.0000438	0.000131
				Nickel	0.20	0.45	0.0000876	0.000197
		2	105					
				Fluoride	15	45	0.00657	0.0197
				Chromium	0.10	0.30	0.0000438	0.000131
				Copper	0.10	0.30	0.0000438	0.000131
				Nickel	0.10	0.30	0.0000438	0.000131
		3	0					
				Fluoride	-	-	-	-
				Chromium	-	-	-	-
				Copper	-	-	-	-
				Nickel	-	-	-	-
	2. Continuous	1*	345					
				Fluoride	15	45	0.0216	0.0647
				Chromium	0.10	0.30	0.000144	0.000432
				Copper	0.10	0.30	0.000144	0.000432
				Nickel	0.20	0.45	0.000288	0.000648
		2	345					
				Fluoride	15	45	0.0216	0.0647
				Chromium	0.10	0.30	0.000144	0.000432
				Copper	0.10	0.30	0.000144	0.000432
				Nickel	0.10	0.30	0.000144	0.000432
		3	0					
				Fluoride	-	-	-	-
				Chromium	-	-	-	-
				Copper	-	-	-	-
				Nickel	-	-	-	-

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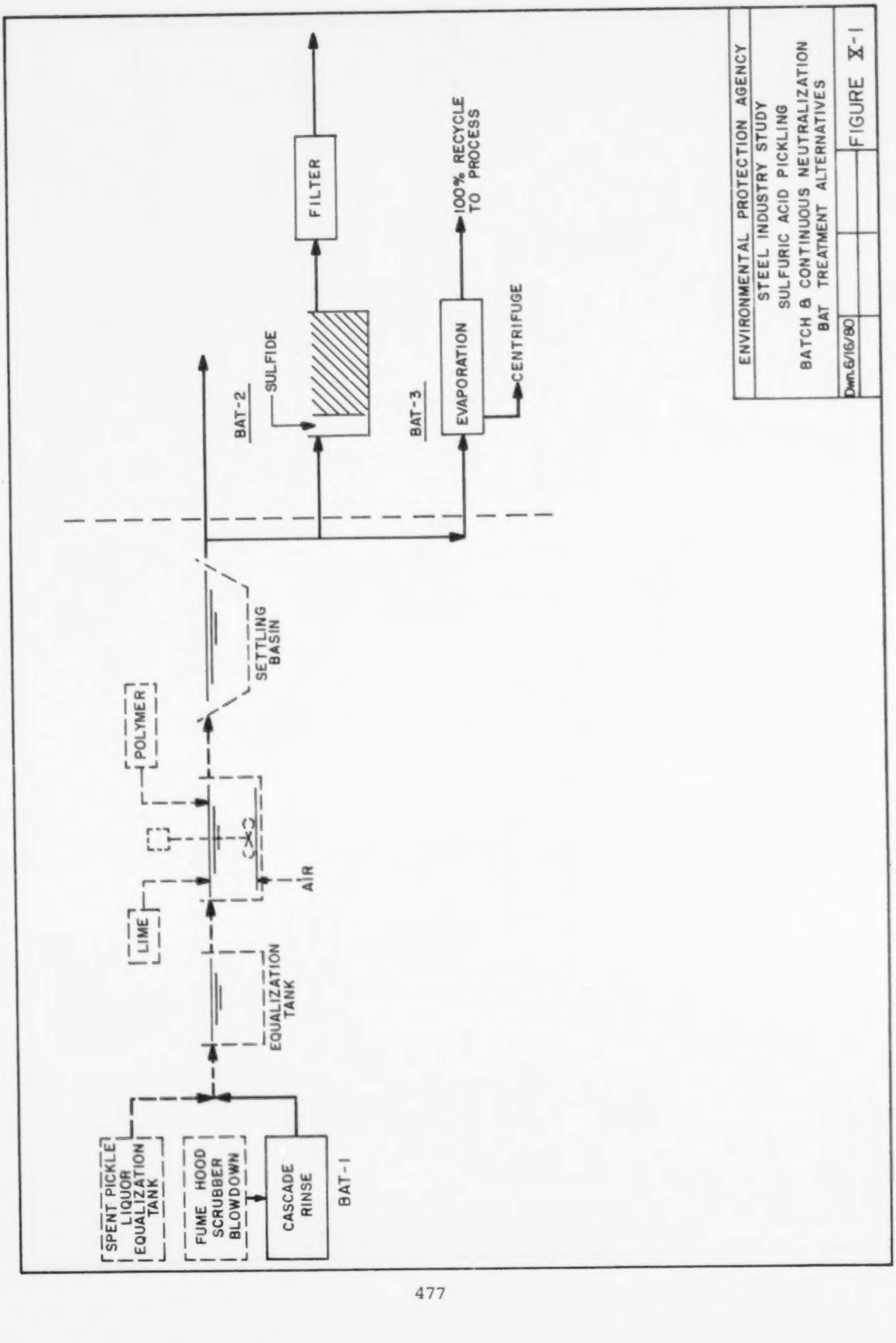
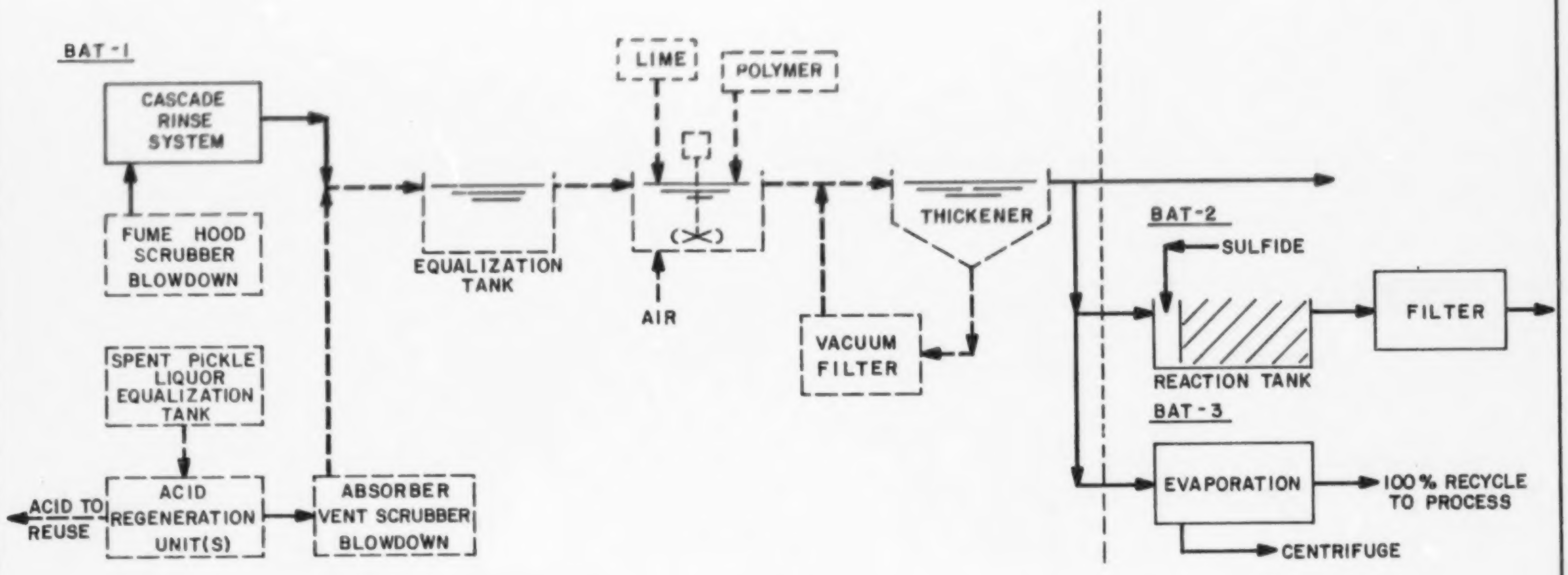
* : BAT Alternative selected.
Note: The fluoride load in combination acid pickling is allowed only when hydrofluoric acid is used.



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BAT TREATMENT ALTERNATIVES

Dwn. 6/16/80

FIGURE X-1

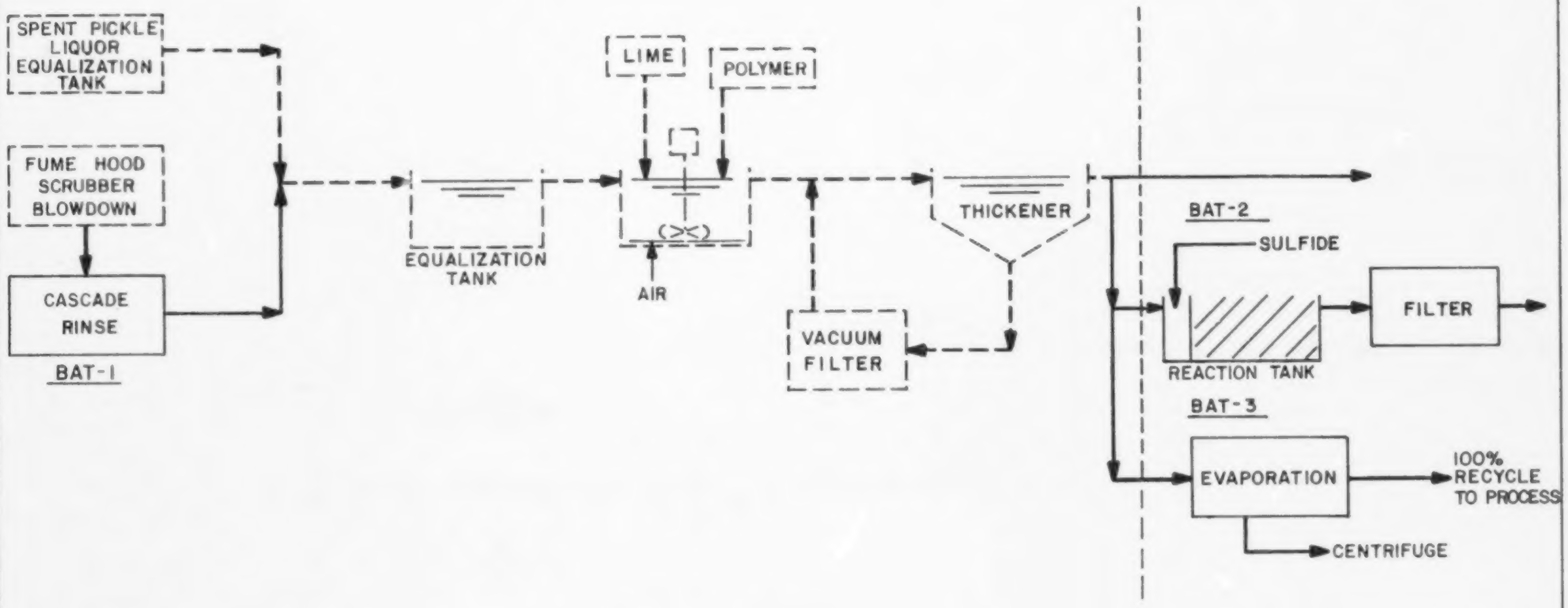


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
CONTINUOUS ACID REGENERATION
BAT TREATMENT ALTERNATIVES

Dwn.6/17/80

FIGURE X-2

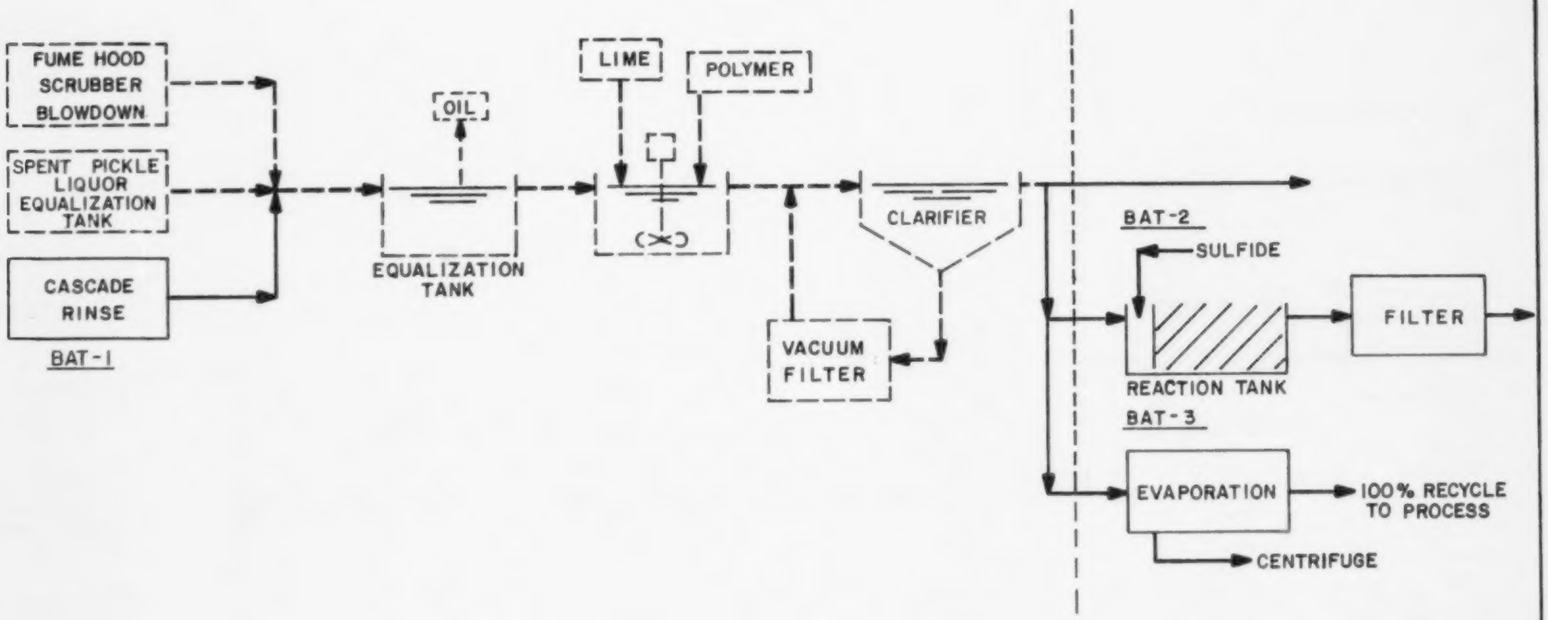


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BAT TREATMENT ALTERNATIVES

Dwn. 6/16/80

FIGURE X-3



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BAT TREATMENT ALTERNATIVES

Dwn. 6/18/80

FIGURE X-4

ACID PICKLING SUBCATEGORY

SECTION XI

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

Introduction

The 1977 Amendments added Section 301(b)(4)(E) to the Act, establishing "best conventional pollutant control technology" (BCT) for discharges of conventional pollutants from existing industrial point sources. Conventional pollutants are those defined in Section 304(b)(4) - BOD, TSS, fecal coliform and pH - and any additional pollutants defined by the Administrator as "conventional." On July 28, 1978, EPA proposed that COD, oil and grease, and phosphorus be added to the conventional pollutant list (43 Fed. Reg. 32857). Only oil and grease was added.

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. BCT requires that limitations for conventional pollutants be assessed in light of a new "cost-reasonableness" test, which involves a comparison of the cost and level of reduction of conventional pollutants from the discharge of POTWs to the cost and level of reduction of such pollutants from a class or category of industrial sources. As part of its review of BAT for certain "secondary" industries, EPA proposed methodology for this cost test. (See 43 Fed. Reg. 37570, August 23, 1978).

Methodology

Reference is made to Volume I for a review of the BCT methodology.

BCT Treatment Alternatives

BCT treatment has not been considered for those sulfuric acid plants practicing acid recovery. Zero discharge is attained at BPT by this model. Therefore, further reduction of conventional pollutants is not necessary. The proposed BCT limitations for sulfuric acid recovery plants are the same as the proposed BPT limitations.

BCT Alternative No. 1

The BCT alternative treatment systems developed for the other operations in the acid pickling subcategory are add-ons to the respective BPT model treatment systems. The first BCT alternative is identical to the BAT-1 developed in each subdivision. A cascade rinse system is incorporated in this alternative to reduce the rinse flow entering the treatment system. In the hydrochloric and sulfuric acid subdivisions, the fume scrubber blowdown is fed to the cascade rinse system. However, zero discharge from fume scrubbers at combination acid pickling operations has not been demonstrated. Therefore, in the combination acid pickling model, fume scrubber blowdown is not fed to the cascade rinse system at the BCT level of treatment.

BCT Alternative No. 2

The second BCT alternative treatment system passes the discharge flow from the BCT-1 treatment system through a filter. Filtration technology provides for additional removal of conventional pollutants than that accomplished by sedimentation. The BCT alternative treatment systems are depicted in Figures XI-1 through XI-4.

Development of BCT Limitations

The reference POTW treatment cost for the conventional pollutants is $1.34/lb (July 1, 1978). (See Section X of Volume I). The BCT cost test is detailed in Section VIII with the results listed in Tables VIII-43 through VIII-46 . A pass/fail summary of the BCT cost test for the acid pickling subcategory follows:

Subdivision		BCT Cost Test Results for the BCT Alternatives	
		1	2
Sulfuric Acid	- Batch Neutralization	Fail	Fail
	- Continuous Neutralization	Fail	Fail
Hydrochloric Acid			
	- Acid Regneration	Pass	Pass*
	- Batch Neutralization	Fail	Fail
	- Continuous Neutralization	Pass	Pass*
Combination Acid			
	- Batch	Fail	Fail
	- Continuous	Fail	Fail

*Selected as the BCT Alternative

The Agency is proposing BCT limitations for suspended solids, oil and grease, and pH. However, the oil and grease limitations are applicable only when acid pickling wastewaters are treated in combination with cold rolling wastewaters. Reference is made to Appendix A of Volume I for the derivation of performance standards for suspended solids and oil and grease.

Proposed BCT Limitations

The proposed BCT limitations are presented in Table XI-1. Proposed BCT limitations for those segments of the acid pickling subcategory which did not pass the BCT Cost Test are the same as the proposed BPT limitations. The proposed BCT limitations were calculated by multiplying the effluent flow incorporated in the chosen treatment model and the corresponding concentrations of suspended solids and oil and grease, with appropriate conversion factors.

TABLE XI-1

BCT EFFLUENT LIMITATIONS GUIDELINES
ACID PICKLING SUBCATEGORY

	Total Suspended Solids (lbs/1000 lbs)		Oil and Grease[1] (lbs/1000 lbs)		Model Selected
Subdivision	Ave.	Max.	Ave.	Max.	
Sulfuric Acid Pickling					
1. Batch Neutralization	0.0751	0.225	0.0150	0.0450	BPT
2. Continuous Neutralization					
(with spent pickle liquor)	0.0521	0.156	0.0104	0.0312	BPT
(without spent pickle liquor)	0.0469	0.141	0.00939	0.0282	BPT
Hydrochloric Acid Pickling					
1. Batch Neutralization					
(with scrubber)	0.0584	0.175	0.0117	0.0351	BPT
(without scrubber)	0.0480	0.144	0.00960	0.0288	BPT
2. Continuous Neutralization	0.00344	0.00917	-	0.00229	BCT-2
3. Continuous Acid Regeneration	0.00438	0.0117	-	0.00292	BCT-2
Combination Acid Pickling					
1. Batch (Pipe and Tube)	0.0730	0.219	0.0292	0.0876	BPT
2. Batch (Other)	0.0209	0.0627	0.00834	0.0249	BPT
3. Continuous	0.104	0.312	0.0417	0.125	BPT

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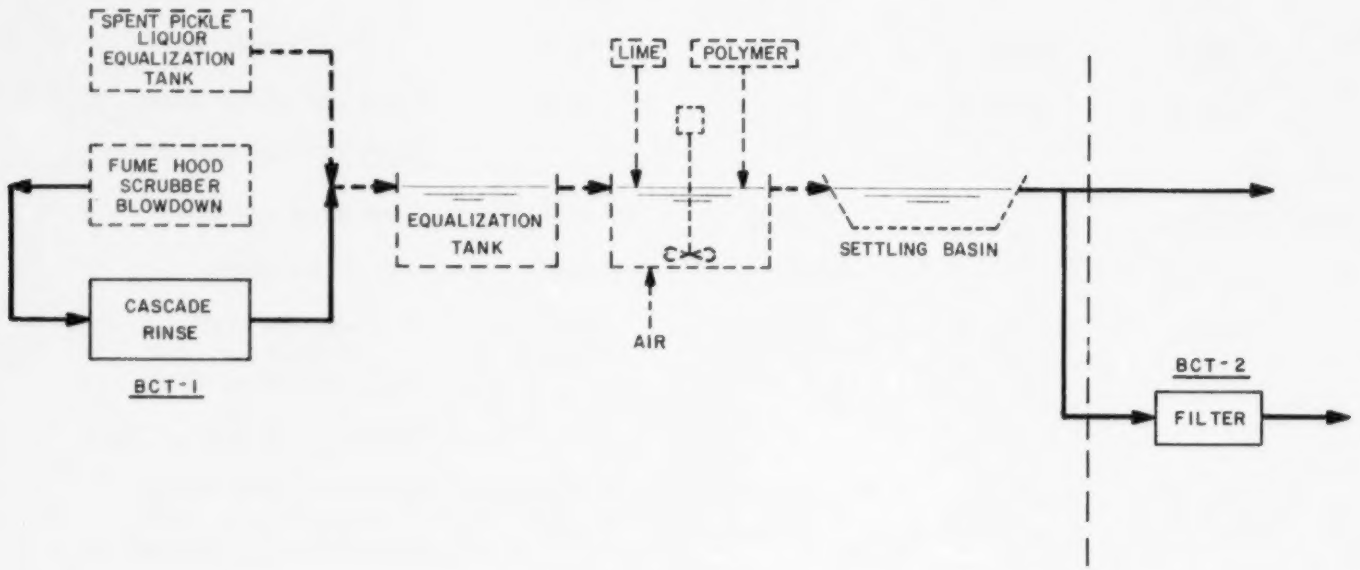
(1) This load is allowed only when these wastes are treated in combination with cold rolling mill wastes.

Note: pH is also limited in this subcategory at BCT to the range 6.0 to 9.0 standard units.

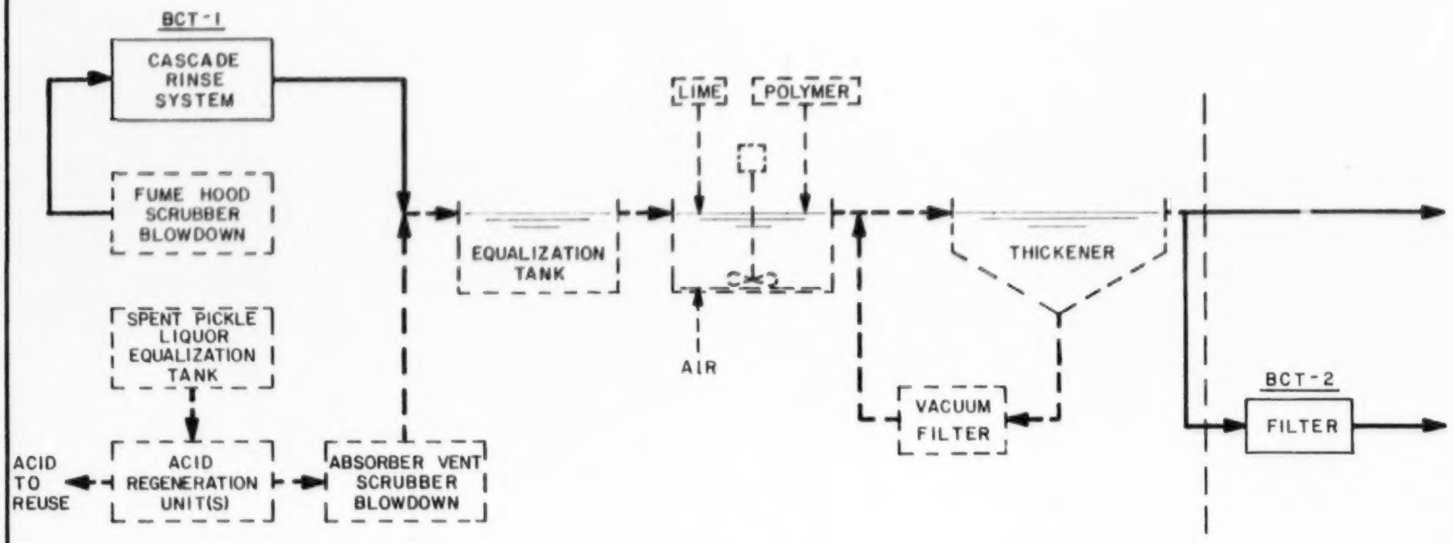


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BCT TREATMENT ALTERNATIVES

Dwn. 11/25/80

FIGURE XI-1

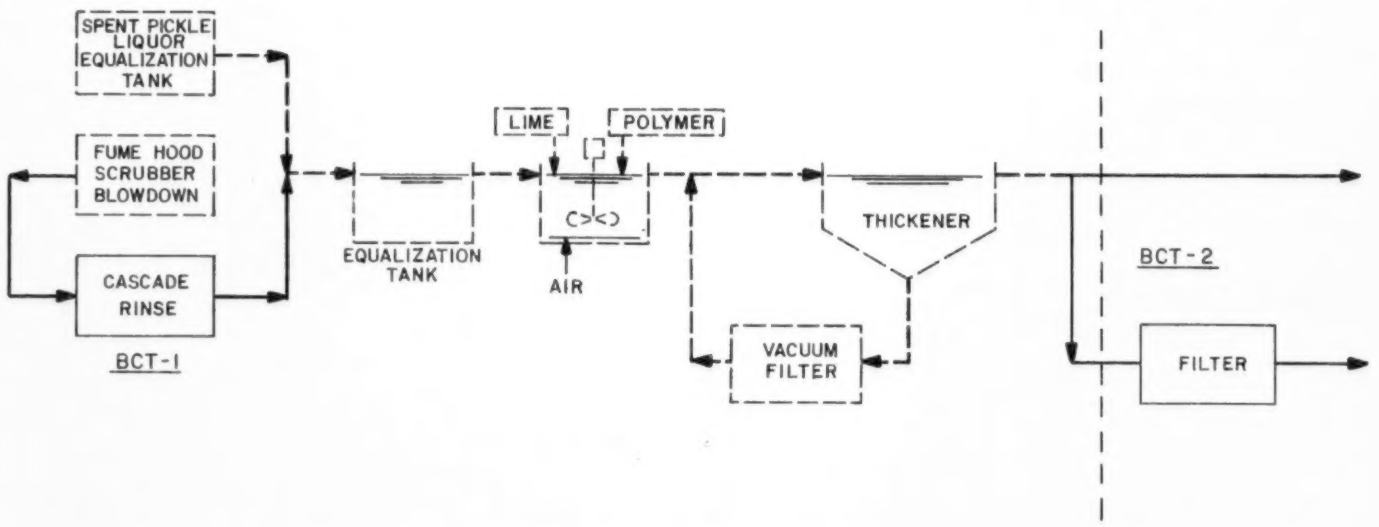

BCT-1
CASCADE RINSE SYSTEM
FUME HOOD SCRUBBER BLOWDOWN
SPENT PICKLE LIQUOR EQUALIZATION TANK
ACID TO REUSE
ACID REGENERATION UNIT(S)
ABSORBER VENT SCRUBBER BLOWDOWN
EQUALIZATION TANK
LIME
POLYMER
AIR
THICKENER
VACUUM FILTER
BCT-2
FILTER

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
CONTINUOUS ACID REGENERATION
BCT TREATMENT ALTERNATIVES

Dwn. 11/25/80

FIGURE XI-2

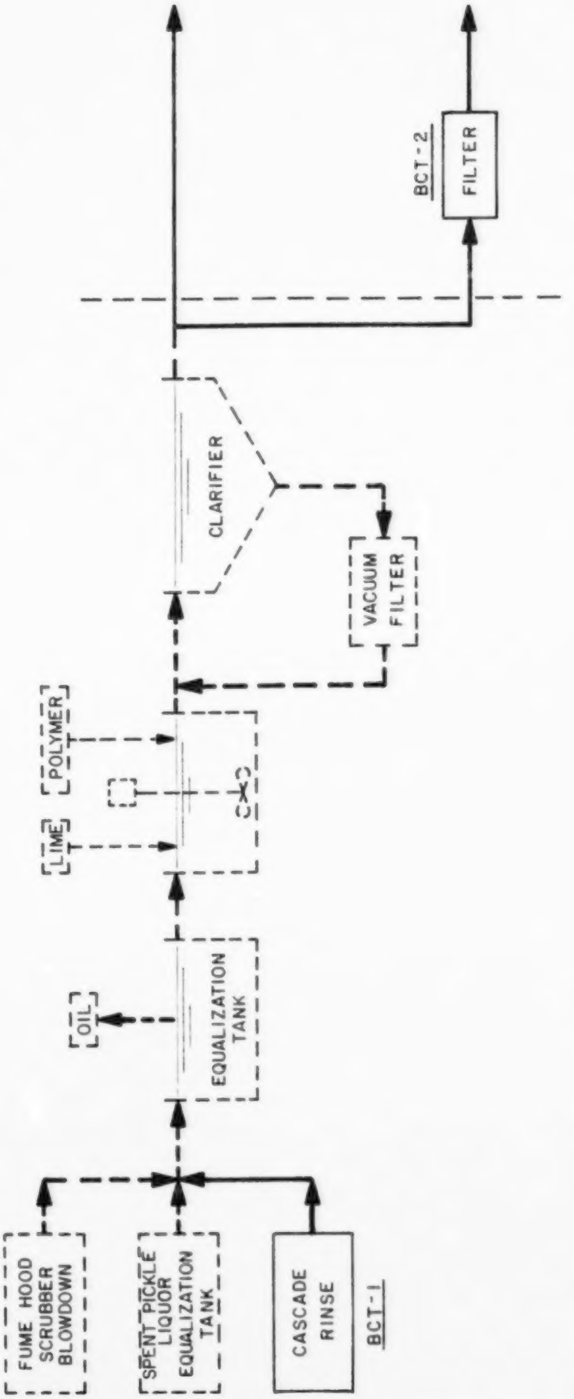


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BCT TREATMENT ALTERNATIVES

DWN.11/26/80

FIGURE XI -3



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
BCT TREATMENT ALTERNATIVES

FIGURE XI-4

Dwn. 11/26/80

ACID PICKLING SUBCATEGORY

SECTION XII

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF NEW SOURCE PERFORMANCE STANDARDS

Introduction

A new source is defined as any source constructed after the proposal of New Source Performance Standards (NSPS). The effluent standards, which must be achieved by new sources, are to specify the degree of effluent reduction achievable through the application of the Best Available Demonstrated Control Technology (BADCT), including, where applicable, a standard permitting no discharge of pollutants. This section identifies the treatment alternatives considered by the Agency for NSPS and the resulting effluent standards for acid pickling operations. In addition, the rationale for selecting the NSPS treatment models, flow values, and proposed effluent standards are discussed.

Identification of NSPS

Acid Recovery

NSPS for continuous and batch sulfuric acid pickling operations are proposed at zero discharge. The alternative treatment systems which achieve this level of reduction are identical to the continuous and batch acid recovery BPT model treatment systems for sulfuric acid pickling operations. Refer to Figure XII-1.

Two NSPS alternative treatment systems have been developed for hydrochloric and combination acid pickling operations. Descriptions of these alternatives follow. Refer to Figures XII-2 through XII-4 for illustrations of these model treatment systems.

NSPS Alternative No. 1

The first NSPS alternative treatment systems are similar to the BPT and BAT-1 treatment systems developed for the hydrochloric and combination acid pickling subdivisions. For the batch and continuous neutralization models in the hydrochloric acid subdivision, the NSPS-1 treatment system consists of spent acid equalization; fume scrubber recycle with subsequent blowdown to the cascade rinse system; equalization of spent pickle liquor and cascade rinsewaters; neutralization with lime; flocculation with polymer; aeration; clarification; and vacuum filtration of the clarifier underflow. The batch and continuous neutralization model in the combination acid pickling subdivision is identical to the corresponding model for hydrochloric operations, except that aeration is not a treatment system component. The NSPS-1 treatment system developed for continuous hydrochloric acid regeneration operations incorporates all of the treatment components just discussed. In addition, an acid regeneration unit and absorber vent scrubber recycle system are included in the treatment system prior to the equalization unit.

NSPS Alternative No. 2

The second NSPS alternative treatment systems are similar to the corresponding BPT and BAT-2 treatment systems developed for the hydrochloric and combination acid pickling subdivisions. For the batch and continuous neutralization models, in both subdivisions, NSPS-2 treats the NSPS-1 system discharge by sulfide precipitation and filtration. The NSPS-2 model developed for continuous hydrochloric acid regeneration operations incorporates the NSPS-1 treatment systems developed for these operations. In addition, the discharges from the NSPS-1 systems are treated with sulfide and then filtered.

Rationale for NSPS

Alternative Treatment Systems

The NSPS alternative treatment systems developed for the acid pickling subcategory are similar to the BPT, BAT-1, and BAT-2 treatment systems described in Sections IX and X. Therefore, the rationale presented in those sections is applicable to NSPS.

Flows

The applied and discharge flows developed for the zero discharge sulfuric acid recovery model at NSPS are identical to the correspondng model BPT flow values. Refer to Section IX. The applied and discharge flows developed for the other NSPS treatment systems are identical to the BAT-1 and BAT-2 raw and effluent flows developed for operations in the hydrochloric acid subdivision. Refer to Section X for the development of these flow values. In the combination acid pickling subdivision, the raw concentrate and fume hood scrubber flows are identical to those developed at BAT (see Section X). However, the raw rinse flows have been lowered from those used in the BAT model. In the batch NSPS system, the raw rinse flow is 200 GPT as compared to 520 GPT at BAT. In the continuous NSPS system, the raw rinse flow is 500 GPT in comparison with the value of 1800 GPT incorporated in the BAT system. Applied flows for combination acid pickling operations were lowered to the Best Demonstrated Flows for NSPS. Flows for sulfuric and hydrochloric acid plants were not lowered at NSPS. However, the Agency is soliciting comments on the use of best demonstrated flows for NSPS in these subdivisions.

Selection of NSPS Alternative

The acid recovery model, which achieves zero discharge, has been chosen for batch and continuous sulfuric acid pickling operations. NSPS Alternative No. 1 has been selected as the model treatment system upon which the proposed NSPS effluent standards are based for all hydrochloric and combination acid pickling operations. The Agency selected the first alternative rather than the second, because the sulfide precipitation technology included in the second alternative has not been demostrated in this subcategory.

The proposed NSPS effluent standards are presented in Table XII-1. The NSPS model treatment systems are designated by asterisks.

TABLE XII-1

NEW SOURCE PERFORMANCE STANDARDS
ACID PICKLING SUBCATEGORY

Subdivision	Process	NSPS Alternative	Discharge Flow (GPT)	Pollutant	Concentration Basis (mg/l)		Effluent Standards (lb/1000 lb	
					Ave.	Max.	Ave.	Max.
Sulfuric	Batch	1*	0					
	Continuous	1*	0					
Hydrochloric								
	Batch Neutralization	1*	90	TSS	30	60	0.0113	0.0225
				O&G	10	20	0.00375	0.00750
				Chromium	0.10	0.30	0.0000375	0.000113
				Lead	0.10	0.30	0.0000375	0.000113
				Zinc	0.10	0.30	0.0000375	0.000113
				pH, Units		6.0 to 9.0		
		2	90	TSS	15	40	0.00563	0.0150
				O&G	-	10	-	0.00375
				Chromium	0.10	0.30	0.0000375	0.000113
				Lead	0.10	0.30	0.0000375	0.000113
				Zinc	0.10	0.30	0.0000375	0.000113
				pH, Units		6.0 to 9.0		
	Continuous Neutralization	1*	55	TSS	30	60	0.00688	0.0138
				O&G	10	20	0.00229	0.00458
				Chromium	0.10	0.30	0.0000229	0.0000687
				Lead	0.10	0.30	0.0000229	0.0000687
				Zinc	0.10	0.30	0.0000229	0.0000687
				pH, Units		6.0 to 9.0		
		2	55	TSS	15	40	0.00344	0.00917
				O&G	-	10	-	0.00229
				Chromium	0.10	0.30	0.0000229	0.0000687
				Lead	0.10	0.30	0.0000229	0.0000687
				Zinc	0.10	0.30	0.0000229	0.0000687
				pH, Units		6.0 to 9.0		
	Continuous Acid Regeneration	1*	70	TSS	30	60	0.00876	0.0175
				O&G	10	20	0.00292	0.00584
				Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
				pH, Units		6.0 to 9.0		

TABLE XII-1
NEW SOURCE PERFORMANCE STANDARDS
ACID PICKLING SUBCATEGORY
PAGE TWO

Subdivision	Process	NSPS Alternative	Discharge Flow (GPT)	Pollutant	Concentration Basis (mg/l) Ave.	Concentration Basis (mg/l) Max.	Effluent Standards (lb/1000 lb Ave.	Effluent Standards (lb/1000 lb Max.
		2	70	TSS	15	40	0.00438	0.0117
				O&G	-	10	-	0.00292
				Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
				pH, Units		6.0 to 9.0		
Combination	Batch	1*	45	TSS	30	60	0.00563	0.0113
				O&G	10	20	0.00188	0.00376
				Fluoride	15	45	0.00281	0.00844
				Chromium	0.10	0.30	0.0000188	0.0000564
				Copper	0.10	0.30	0.0000188	0.0000564
				Nickel	0.20	0.45	0.0000375	0.0000844
				pH, Units		6.0 to 9.0		
		2	45	TSS	15	40	0.00281	0.00751
				O&G	-	10	-	0.00188
				Fluoride	15	45	0.00281	0.00844
				Chromium	0.10	0.30	0.0000188	0.0000564
				Copper	0.10	0.30	0.0000188	0.0000564
				Nickel	0.10	0.30	0.0000188	0.0000564
				pH, Units		6.0 to 9.0		
	Continuous	1*	90	TSS	30	60	0.0113	0.0225
				O&G	10	20	0.00375	0.00750
				Fluoride	15	45	0.00563	0.0169
				Chromium	0.10	0.30	0.0000375	0.000113
				Copper	0.10	0.30	0.0000375	0.000113
				Nickel	0.20	0.45	0.0000751	0.000169
				pH, Units		6.0 to 9.0		
		2	90	TSS	15	40	0.00563	0.0150
				O&G	-	10	-	0.00375
				Fluoride	15	45	0.00563	0.0169
				Chromium	0.10	0.30	0.0000375	0.000113
				Copper	0.10	0.30	0.0000375	0.000113
				Nickel	0.10	0.30	0.0000375	0.000113
				pH, Units		6.0 to 9.0		

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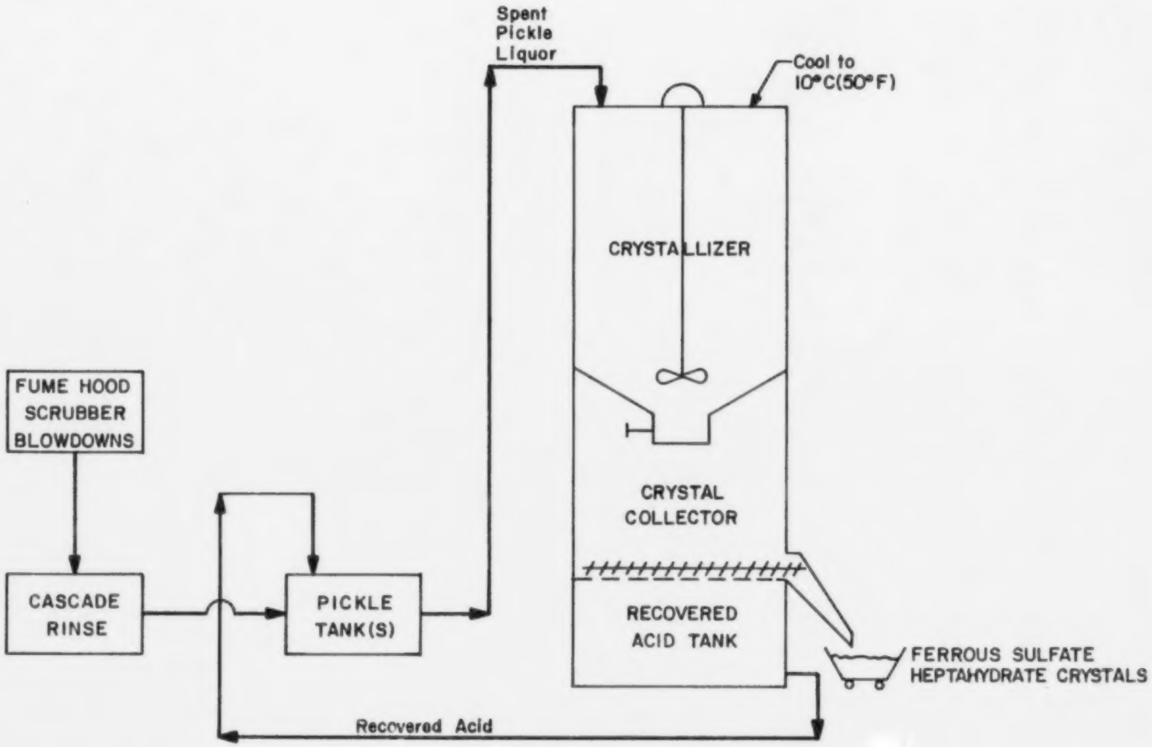
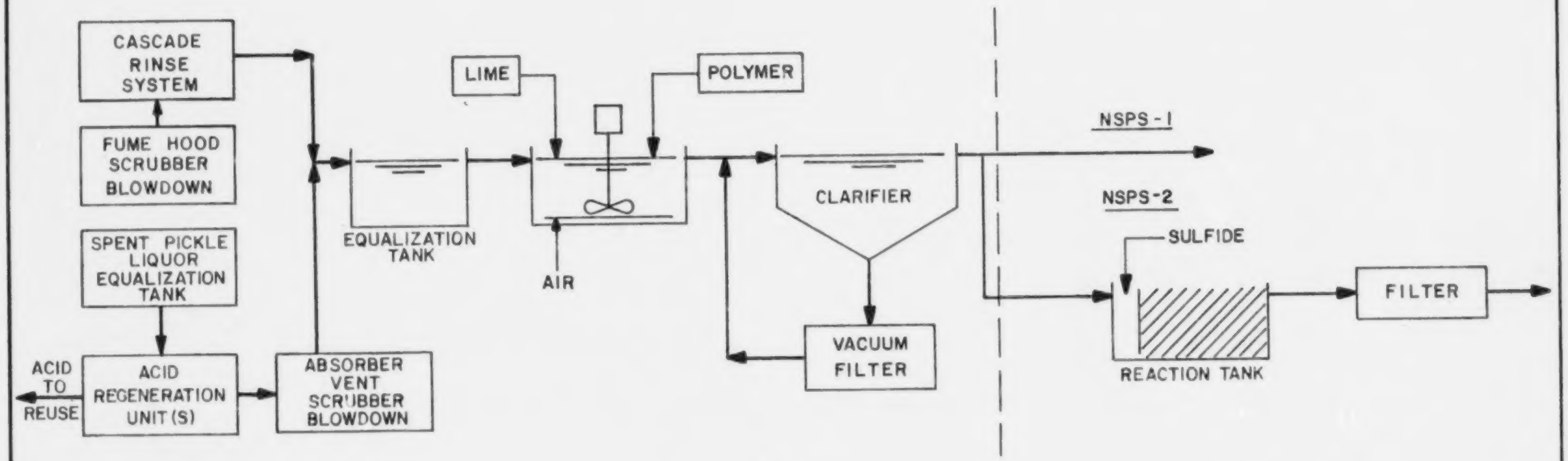
*: Alternative selected.
Note: The fluoride load is allowed only when hydrofluoric acid is used.



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING
CONTINUOUS & BATCH OPERATIONS
NSPS TREATMENT MODEL

Dwn.6/12/80

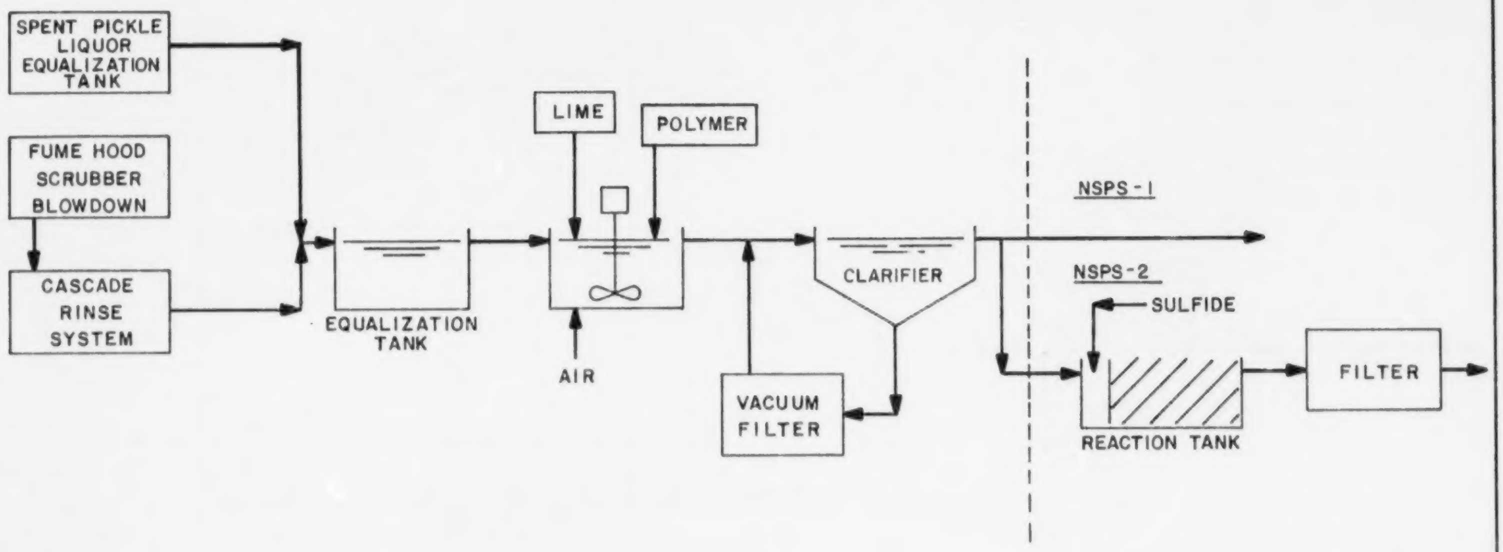
FIGURE XII-1



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
CONTINUOUS ACID REGENERATION
NSPS TREATMENT ALTERNATIVES

Dwn.6/18/80

FIGURE XII-2

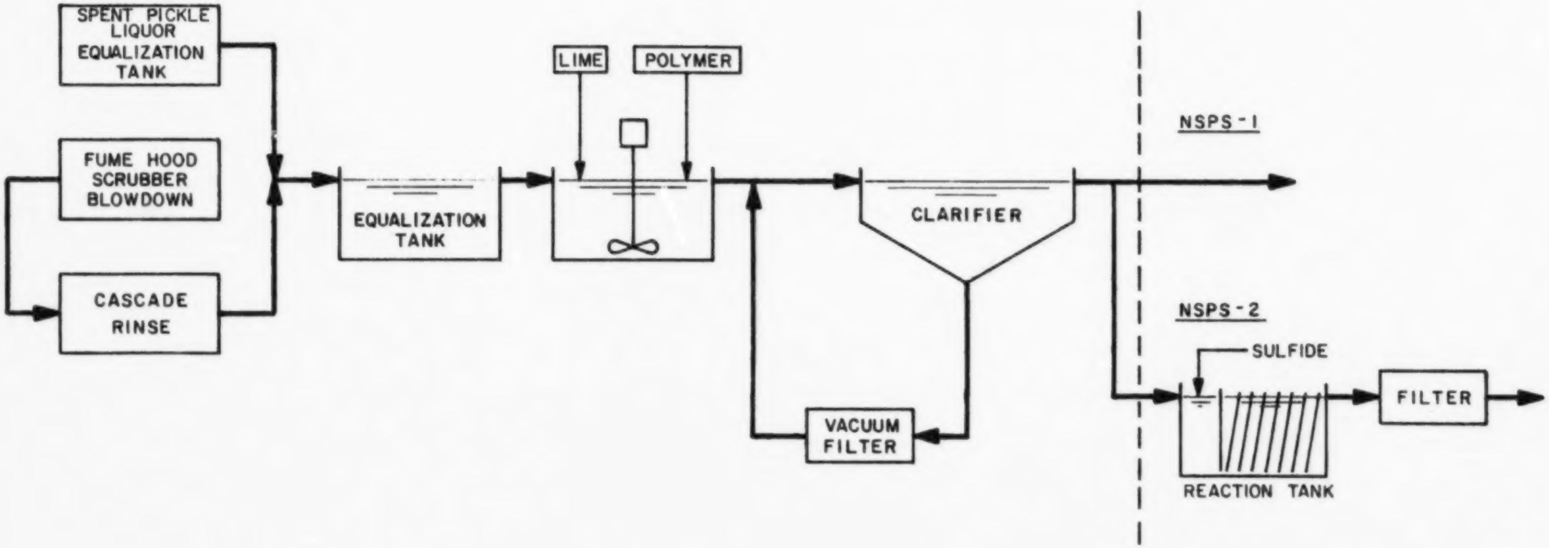


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
NSPS TREATMENT ALTERNATIVES

Dwn. 6/18/80

FIGURE XII-3



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
NSPS TREATMENT ALTERNATIVES

Dwn. 11/21/80

FIGURE XII-4

ACID PICKLING SUBCATEGORY

SECTION XIII

PRETREATMENT STANDARDS FOR DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS

Introduction

This section discusses the alternative control and treatment systems available for acid pickling operations which discharge wastewaters to publicly owned treatment works (POTWs). The main factors considered in the pretreatment standards are: (1) the need to ensure that the acid pickling wastewaters are treated sufficiently to avoid overloading POTW systems, and (2) that provisions for toxic pollutant removal are incorporated such that these pollutants do not interfere with or pass through the POTW, or are not otherwise incompatible with POTW operations.

The Agency developed separate pretreatment systems for existing (PSES) and new (PSNS) operations in the sulfuric and combination acid pickling subdivisions. However, in the hydrochloric acid pickling subdivision, PSES and PSNS systems are identical.

General Pretreatment Regulations, 40 CFR Part 403, are applicable to all acid pickling sources. A discussion of the general pretreatment and categorical pretreatment standards applying to acid pickling operations follow.

General Pretreatment Standards

For detailed information concerning Pretreatment Standards, refer to 43 FR 27736-27773, "General Pretreatment Regulations for Existing and New Sources of Pollution," (June 26, 1978). In particular, 40 CFR Part 403 describes national standards (prohibited discharges and categorical standards), revision of categorical standards through removal allowances, and POTW pretreatment programs.

The General Pretreatment Regulations set forth general discharge prohibitions that apply to all non-domestic users of POTWs to prevent pass through of pollutants, interference with the operation of POTWs, and municipal sludge contamination. The regulations also establish administrative mechanisms to ensure application and enforcement of prohibited discharge limits and categorical pretreatment standards. In addition, the Regulations contain provisions relating directly to the determination of and reporting on Pretreatment Standards.

Categorical Pretreatment Standards

In establishing pretreatment standards for acid pickling operations, the Agency gave primary consideration to the objectives and requirements of the General Pretreatment Regulations. In addition, the Agency considered other factors specifically applicable to acid pickling operations.

Although wastewaters from a significant number of pickling operations are discharged to POTWs, the POTWs are not designed to treat toxic metal pollutants present in pickling wastewaters. Instead, POTWs are designed to treat biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform bacteria, and pH. Toxic metal removal by POTWs is incidental to the POTW's main function of treating conventional pollutants. POTWs have historically accepted many pollutants in amounts well above their capacity to treat them adequately. The problems of municipal sludge disposal are becoming increasingly difficult to resolve. Pretreatment standards must address toxic pollutant removal. This will greatly reduce the transfer of these pollutants to POTWs where they concentrate in the sludges.

Due to the presence of toxic metal pollutants in pickling wastewaters, extensive pretreatment must be provided to ensure that these pollutants do not interfere with or pass through the POTWs, or are not otherwise incompatible with POTW operations or cause harm to the treatment plant. In general, the alternative treatment systems are comparable to the BAT alternative treatment systems. Pretreatment standards for suspended solids and oil and grease are not proposed. These pollutants, in the amounts present in acid pickling BPT effluents, are compatible with POTW operations and can be effectively treated at POTWs.

Various studies[1] have demonstrated that the toxic metal pollutants found in wastewaters at levels comparable to those present in pickling wastewaters inhibit the biological treatment process. The pretreatment systems ensure that the toxic metal pollutants present in the pickling wastewater discharges of these segments will not adversely affect the treatment process.

Other studies[2] involving the electroplating industry (with similar levels of the same toxic metals) indicated that from fifty percent to ninety percent of the toxic metal pollutants entering a POTW will pass through the system. The possiblity therefore exists that a POTW could discharge undesirable levels of toxic metal pollutants when accepting industrial process wastewaters.

The toxic metal pollutants which do not pass through a POTW are concentrated in the POTW sludges. Generally, land application is the most advantageous, yet least expensive, method of POTW sludge disposal as the sludge can be used to replace soil nutrients. However, excessive amounts of toxic metal pollutants in the sludges could inhibit plant growth, thus rendering the sludge unfit for use as a soil nutrient supplement. In addition, these metals could enter either the plant or animal food chain or could leach into the groundwater. For the above reasons, the Agency believes that the control of toxic metal pollutant discharges to POTWs is essential.

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[1] EPA-430/9-76-017a, Construction Grants Program Information; Federal Guidelines, State and Local Pretreatment Programs

[2] Federal Register; Friday, September 7, 1979; Part IV, Environmental Protection Agency; Effluent Guidelines and Standards; Electroplating Point Source Category; Pretreatment Standards for Existing Sources-Pages 52597-52601.

Rationale for Selection of Pretreatment Systems

Treatment Models

The PSES and PSNS systems developed for the acid pickling subcategory are similar to BPT, BAT-1, and BAT-2 treatment systems described in Sections IX and X. Therefore, the rationale presented in those sections is applicable to PSES and PSNS.

Flows

The applied and discharge flows developed for the PSES and PSNS systems are identical to the BAT-1 and BAT-2 raw and effluent flows for hydrochloric neutralization operations and hydrochloric acid regeneration operations. The applied and discharge flows developed for sulfuric acid recovery operations at PSES and PSNS are identical to the corresponding BPT flows, as are the PSNS flows for sulfuric neutralization operations. PSES flows for sulfuric neutralization operations refect BAT flow values. Refer to Sections IX and X for the development of these flow values.

In the combination acid pickling subdivision, the applied and discharge flow values developed for the PSES alternatives are identical to the corresponding BAT-1 and BAT-2 applied and discharge flow values. Refer to Section X. However, the flow values developed for the PSNS alternative system are identical to the corresponding NSPS applied and discharge flow values. Refer to Section XII for the development of these flow values.

Alternative Pretreatment Systems

A. Sulfuric Acid Pickling

1. PSES

The PSES system developed for sulfuric acid recovery operations is identical to the model BPT treatment system. Refer to Figure XIII-1. The two PSES systems developed for sulfuric acid neutralization operations are similar to the corresponding BPT, BAT-1, and BAT-2 treatment systems. PSES Alternative No. 1 consists of spent acid equalization; fume scrubber recycle with subsequent blowdown to the cascade rinse system; equalization of spent pickle liquor and cascade rinsewaters; neutralization with lime; flocculation with polymer; aeration; clarification; and, vacuum filtration of the clarifier underflow. The filtrate from the vacuum filters is returned to the clarifier inlet. The clarifier overflow is then discharged to the POTW. PSES Alternative No. 2 incorporates all of the Alternative No. 1

treatment components just discussed. In addition, the clarifier overflow is treated with sulfide in a reaction tank. The solids precipitated by the sulfide are removed by filters and the filter effluent is then discharged to a POTW. Figure XIII-2 depicts the treatment models just described.

2. PSNS

The PSNS treatment model developed for all sulfuric acid pickling operations is identical to the NSPS model treatment system for sulfuric operations. This treatment system achieves zero discharge. Refer to Figure XIII-1.

B. Hydrochloric Acid Pickling

1. Acid Regeneration

The PSES/PSNS systems developed for hydrochloric acid regeneration operations include all of the PSES-1 and PSES-2 system components developed for sulfuric acid neutralization operations. In addition, an acid regeneration unit and absorber vent scrubber recycle system are included prior to the equalization unit in each treatment system. Refer to Figure XIII-3.

2. Neutralization

The PSES/PSNS treatment systems developed for hydrochloric acid neutralization operations are identical to the corresponding PSES Alternatives No. 1 and 2 developed for sulfuric acid neutralization operations. Refer to Figure XIII-4.

C. Combination Acid Pickling

1. PSES

The two PSES systems developed for combination acid neutralization operations both include fume hood scrubber recycle; cascade rinse; equalization of spent pickle liquor, fume hood scrubber blowdown, and cascade rinse system; neutralization with lime, and flocculation with polymer. At this point, the PSES Alternative No. 1 treatment system flow passes through a clarifier. The clarifier underflow is vacuum filtered with the filtrate returned to the clarifier inlet. The clarifier overflow then enters the POTW. In the PSES Alternative No. 2 treatment system, the wastewater which has been neutralized with lime and flocculated with polymer then passes to a settling basin. Sludge is removed periodically, and after sufficient retention time, the wastewater is treated with sulfide in a reaction tank. The solids which have been precipitated are removed by filters. The filter effluent then passes to the POTW. Figure XIII-5 depicts the treatment systems just described.

2. PSNS

The PSNS systems developed for combination acid neutralization operations incorporate all of the PSES-1 and PSES-2 treatment components developed for sulfuric acid neutralization operations, with the exception of aeration. Refer to Figure XIII-6.

Selection for Pretreatment Alternatives

The acid recovery system, which achieves zero discharge, has been developed for new batch and continuous sulfuric acid pickling operations (PSNS). This system also applies to existing batch and continuous sulfuric acid recovery operations.

The PSES-1 alternative has been selected as the model treatment system upon which the proposed PSES effluent standards are based for sulfuric and hydrochloric neutralization operations and hydrochloric acid regeneration operations. The PSNS models for the two types of hydrochloric acid pickling operations are identical to the corresponding PSES models.

The first PSES and PSNS alternatives have also been selected as the model treatment systems upon which the proposed PSES and PSNS effluent standards are based for combination neutralization operations. The Agency selected the first alternatives for operations in all three subdivisions, because the sulfide precipitation technology incorporated in the second alternatives has not been demonstrated in this subcategory.

The proposed PSES and PSNS effluent standards are presented in Table XIII-1. The selected PSES and PSNS alternatives are designated by asterisks. No effluent standards are proposed for suspended solids and oil and grease, as these are conventional pollutants which can be effectively treated in a POTW.

TABLE XIII-1

PRETREATMENT EFFLUENT STANDARDS (EXISTING AND NEW SOURCES)
ACID PICKLING SUBCATEGORY

Subdivision	Process	Pretreatment Alternative	Flow Basis (GPT)	Pollutants	Concentration Basis (mg/l) Ave.	Concentration Basis (mg/l) Max.	Effluent Standards (lbs/1000 lbs) Ave.	Effluent Standards (lbs/1000 lbs) Max.
Sulfuric	Batch	PSES-1*	70	Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
				pH (Units)		6.0 to 9.0		
		PSES-2	70	Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
				pH (Units)		6.0 - 9.0		
		PSNS*	0		-	-	-	-
	Continuous	PSES-1*	55	Chromium	0.10	0.30	0.0000229	0.0000688
				Lead	0.10	0.30	0.0000229	0.0000688
				Zinc	0.10	0.30	0.0000229	0.0000688
				pH (Units)		6.0 - 9.0		
		PSES-2	55	Chromium	0.10	0.30	0.0000229	0.0000688
				Lead	0.10	0.30	0.0000229	0.0000688
				Zinc	0.10	0.30	0.0000229	0.0000688
				pH (Units)		6.0 - 9.0		
		PSNS*	0		-	-	-	-
Hydrochloric	Batch Neutralization	PSES/PSNS-1*	90	Chromium	0.10	0.30	0.0000375	0.000113
				Lead	0.10	0.30	0.0000375	0.000113
				Zinc	0.10	0.30	0.0000375	0.000113
				pH (Units)		6.0 - 9.0		
		PSES/PSNS-2	90	Chromium	0.10	0.30	0.0000375	0.000113
				Lead	0.10	0.30	0.0000375	0.000113
				Zinc	0.10	0.30	0.0000375	0.000113
				pH (Units)		6.0 - 9.0		

TABLE XIII-1
PRETREATMENT EFFLUENT STANDARDS (EXISTING AND NEW SOURCES)
ACID PICKLING SUBCATEGORY
PAGE TWO

Subdivision	Process	Pretreatment Alternative	Flow Basis (GPT)	Pollutants	Concentration Basis (mg/l) Ave.	Concentration Basis (mg/l) Max.	Effluent Standards (lbs/1000 lbs) Ave.	Effluent Standards (lbs/1000 lbs) Max.
	Continuous Neutralization	PSES/PSNS-1*	55	Chromium	0.10	0.30	0.0000229	0.0000687
				Lead	0.10	0.30	0.0000229	0.0000687
				Zinc	0.10	0.30	0.0000229	0.0000687
				pH (Units)		6.0 - 9.0		
		PSES/PSNS-2	55	Chromium	0.10	0.30	0.0000229	0.0000687
				Lead	0.10	0.30	0.0000229	0.0000687
				Zinc	0.10	0.30	0.0000229	0.0000687
				pH (Units)		6.0 - 9.0		
	Continuous Acid Regeneration	PSES/PSNS-1*	70	Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
				pH (Units)		6.0 - 9.0		
		PSES/PSNS-2	70	Chromium	0.10	0.30	0.0000292	0.0000876
				Lead	0.10	0.30	0.0000292	0.0000876
				Zinc	0.10	0.30	0.0000292	0.0000876
				pH (Units)		6.0 - 9.0		
Combination	Batch	PSES-1*	105	Chromium	0.10	0.30	0.0000438	0.000131
				Copper	0.10	0.30	0.0000438	0.000131
				Nickel	0.20	0.45	0.0000876	0.000197
				pH (Units)		6.0 - 9.0		
		PSES-2	105	Chromium	0.10	0.30	0.0000438	0.000131
				Copper	0.10	0.30	0.0000438	0.000131
				Nickel	0.10	0.30	0.0000438	0.000131
				pH (Units)		6.0 - 9.0		
		PSNS-1*	45	Chromium	0.10	0.30	0.0000188	0.0000563
				Copper	0.10	0.30	0.0000188	0.0000563
				Nickel	0.20	0.45	0.0000375	0.0000844
				pH (Units)		6.0 - 9.0		
		PSNS-2	45	Chromium	0.10	0.30	0.0000188	0.0000563
				Copper	0.10	0.30	0.0000188	0.0000563
				Nickel	0.10	0.30	0.0000188	0.0000563
				pH (Units)		6.0 - 9.0		

TABLE XIII-1
PRETREATMENT EFFLUENT STANDARDS (EXISTING AND NEW SOURCES)
ACID PICKLING SUBCATEGORY
PAGE THREE

Subdivision	Process	Pretreatment Alternative	Flow Basis (GPT)	Pollutants	Concentration Basis (mg/l)		Effluent Standards (lbs/1000 lbs)	
					Ave.	Max.	Ave.	Max.
	Continuous	PSES-1*	345	Chromium	0.10	0.30	0.000144	0.000431
				Copper	0.10	0.30	0.000144	0.000431
				Nickel	0.20	0.45	0.000288	0.000647
				pH (Units)		6.0 - 9.0		
		PSES-2	345	Chromium	0.10	0.30	0.000144	0.000431
				Copper	0.10	0.30	0.000144	0.000431
				Nickel	0.10	0.30	0.000144	0.000431
				pH (Units)		6.0 - 9.0		
		PSNS-1*	90	Chromium	0.10	0.30	0.0000375	0.000113
				Copper	0.10	0.30	0.0000375	0.000113
				Nickel	0.20	0.45	0.0000751	0.000169
				pH (Units)		6.0 - 9.0		
		PSNS-2	90	Chromium	0.10	0.30	0.0000375	0.000113
				Copper	0.10	0.30	0.0000375	0.000113
				Nickel	0.10	0.30	0.0000375	0.000113
				pH (Units)		6.0 - 9.0		

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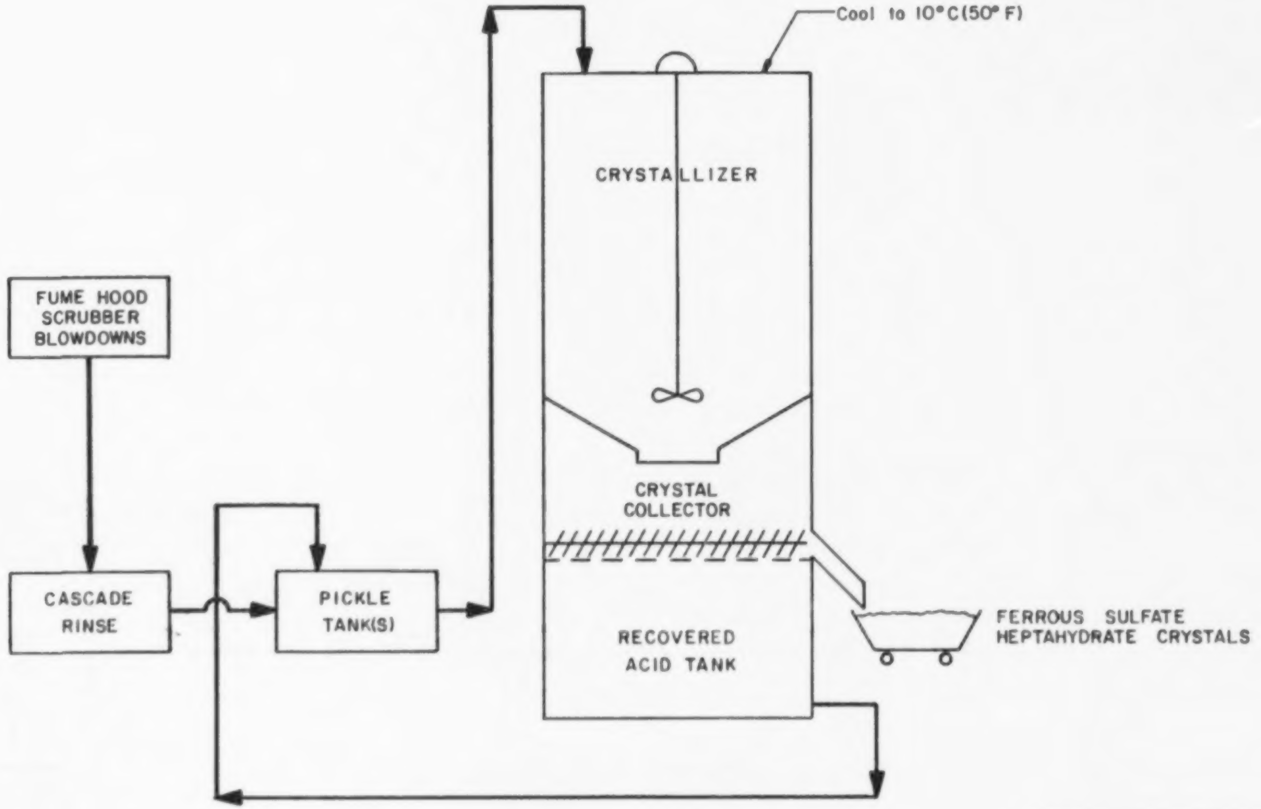
*: Alternative selected

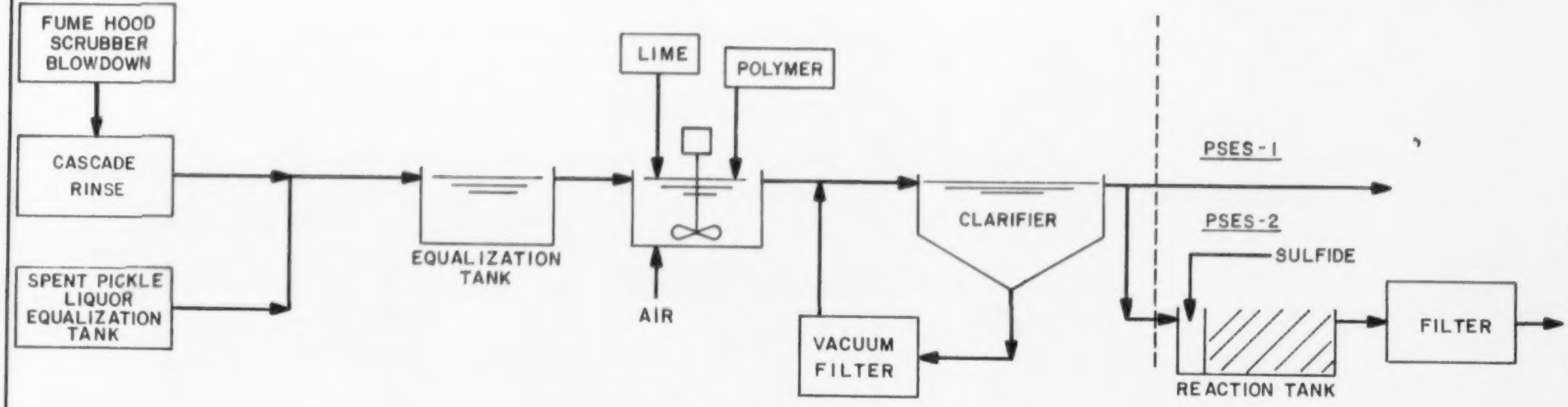


ENVIRONMENTAL PROTECTION AGENCY

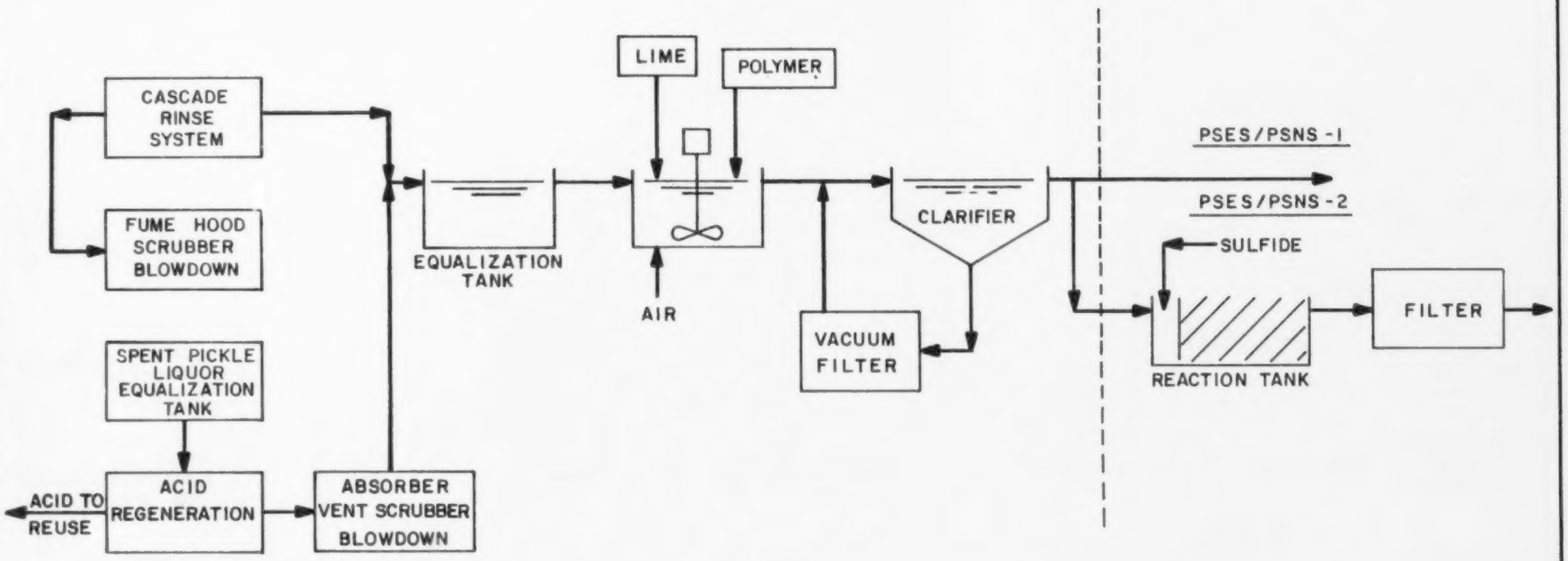
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING
CONTINUOUS & BATCH OPERATIONS
PSNS TREATMENT MODEL

Dwn. 11/22/80

FIGURE XIII-1



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SULFURIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
PSES TREATMENT ALTERNATIVES
Dwn.6/20/80
FIGURE XIII-2

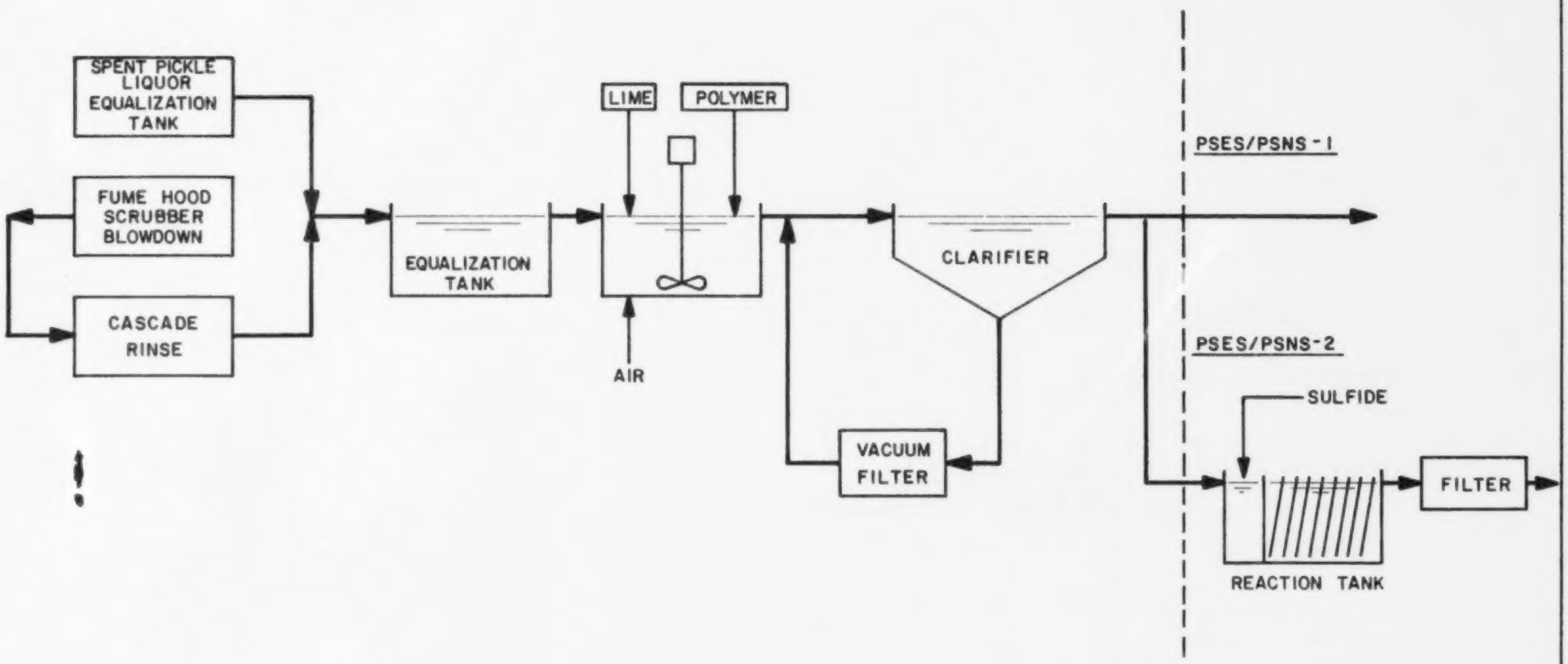


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
CONTINUOUS ACID REGENERATION
PSES/PSNS TREATMENT ALTERNATIVES

Dwn.6/20/80

FIGURE XIII-3

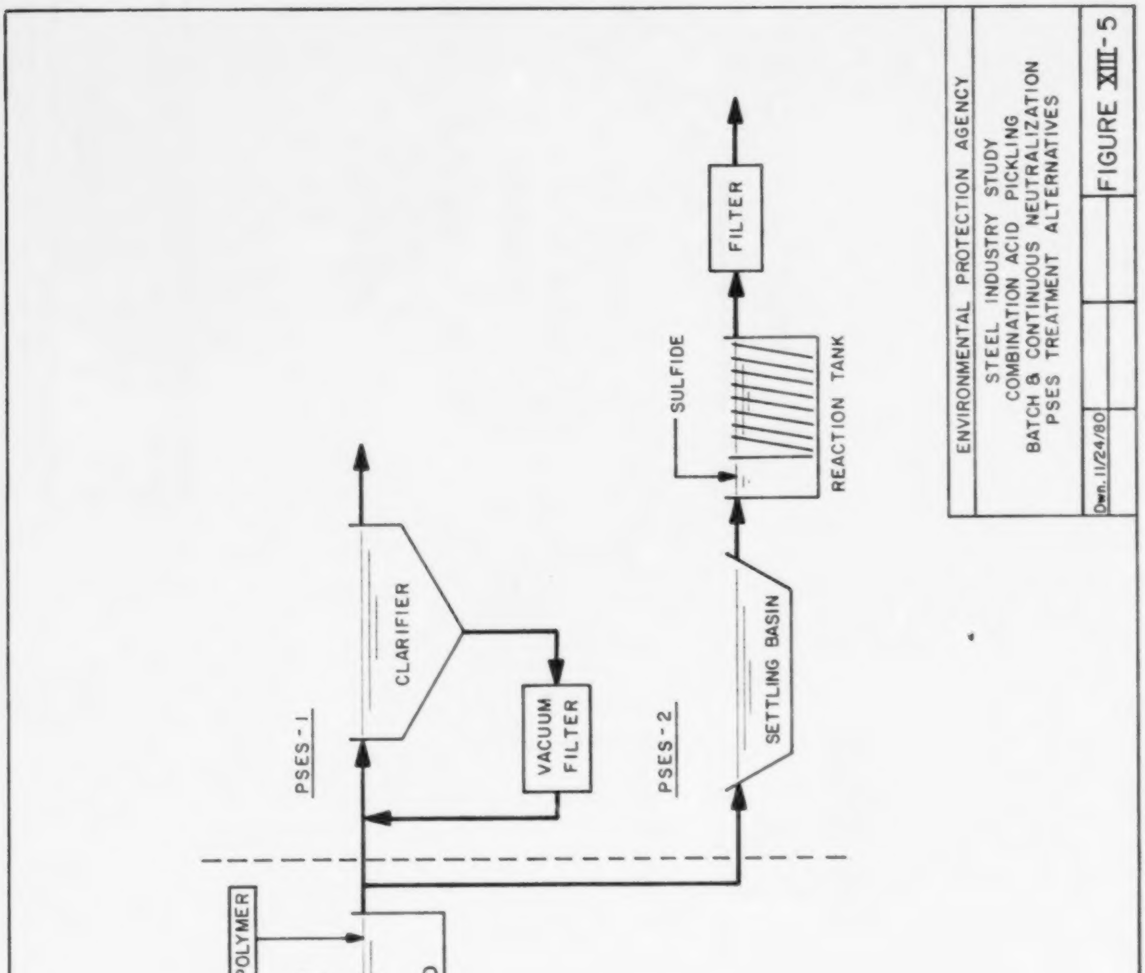


ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HYDROCHLORIC ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
PSES/PSNS TREATMENT ALTERNATIVES

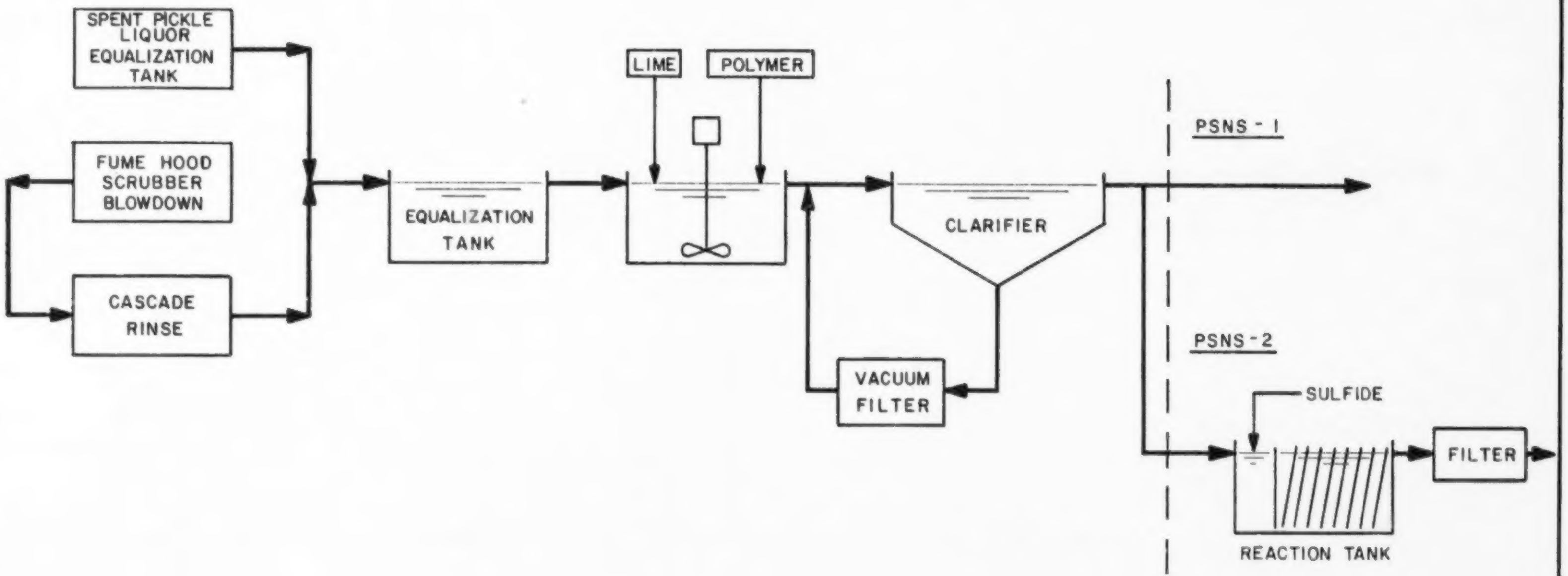
Dwn. 11/22/80

FIGURE XIII-4



ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
PSES TREATMENT ALTERNATIVES

FIGURE XIII-5



ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
COMBINATION ACID PICKLING
BATCH & CONTINUOUS NEUTRALIZATION
PSNS TREATMENT ALTERNATIVES

Dwn. 11/25/80

FIGURE XIII-6